CANADIAN COAST GUARD

RESEARCH & DEVELOPMENT

ANNUAL REPORT

1988/89

90-06613/

DISCLAIMER

This report constitutes an accounting for resources by the Marine Group/Canadian Coast Guard of Transport Canada. This report covers the period April 1, 1988 to March 31, 1989 and as such reflects the organization of that period. Due to recent organizational changes, portions of the report may appear in consistent with more current information, but the content is accurate for the chronological period being reported.

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INTRODUCTION

The functional components and associated Crown Corporations of the Marine Group conduct and participate in R&D programs as an integral part of fulfilling their respective missions. In addition, R&D efforts are used to support the interests of other members of the Canadian marine community, to promote maximum Canadian industrial benefits and to meet other federal economic and regional objectives as appropriate.

Coast Guard, with its broad responsibilities for the regulation and certification of commercial vessels and for the provision of safe navigable waterways, conducts the largest R&D program of the Marine Group components.

Various special sources of funds are available to the Marine Group components to support their R&D programs. The major funding is from within the Marine Group reference level and from special controlled allotments. The remainder is obtained from several interdepartmental R&D programs.

The 1988/89 R&D Annual Report is the third comprehensive annual report of the Marine Group/CCG R&D activities.

The 1988/89 annual R&D report is published in support of our information dissemination and technology transfer policies. It is intended to communicate and share our knowledge and experience and to solicit comments/ suggestions from the industry at large.

VOLUME I

Volume I of the report contains an overview of the results of the Coast Guard R&D program for 1988/89.

Section I of Volume I details the objectives and responsibilities of the Marine Group/CCG, and the individual R&D programs under which projects were carried out.

Section II provides highlights of achievements during FY 1988/89, and program expenditure summaries by funding sources and Key Result Areas (KRA'S)/Fleet Program Areas (as appropriate).

Section III indicates future goals. Appendices which include expenditure summaries for individual programs and detailed project information are published as a separate volume.

Section IV contains a list of reports* which resulted from research projects conducted in 1988/89. Some of the reports may have a restricted distribution because of commercial confidentially of the data, international agreements, etc.

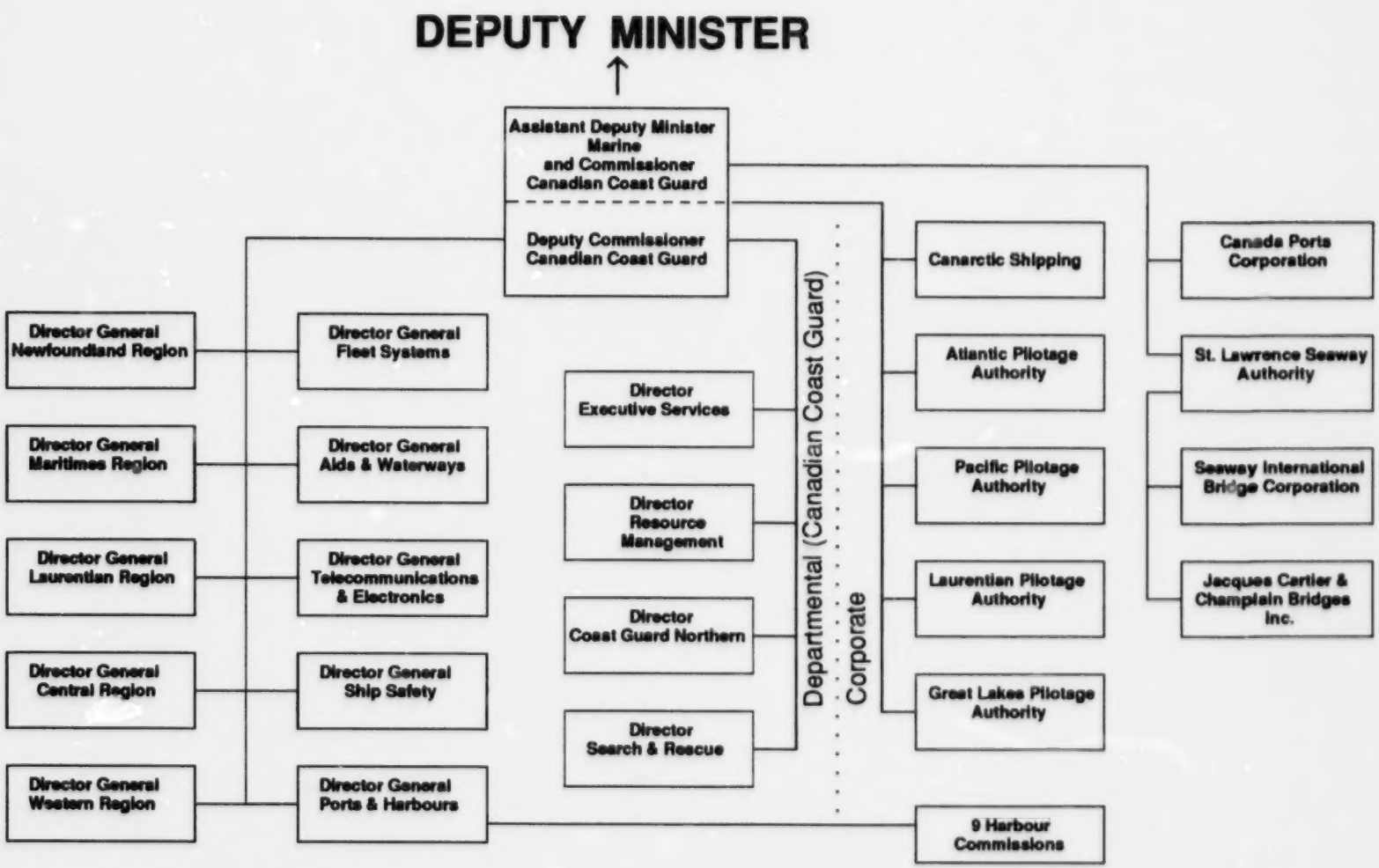
* The list also appears as Appendix H of Volume II.

VOLUME II

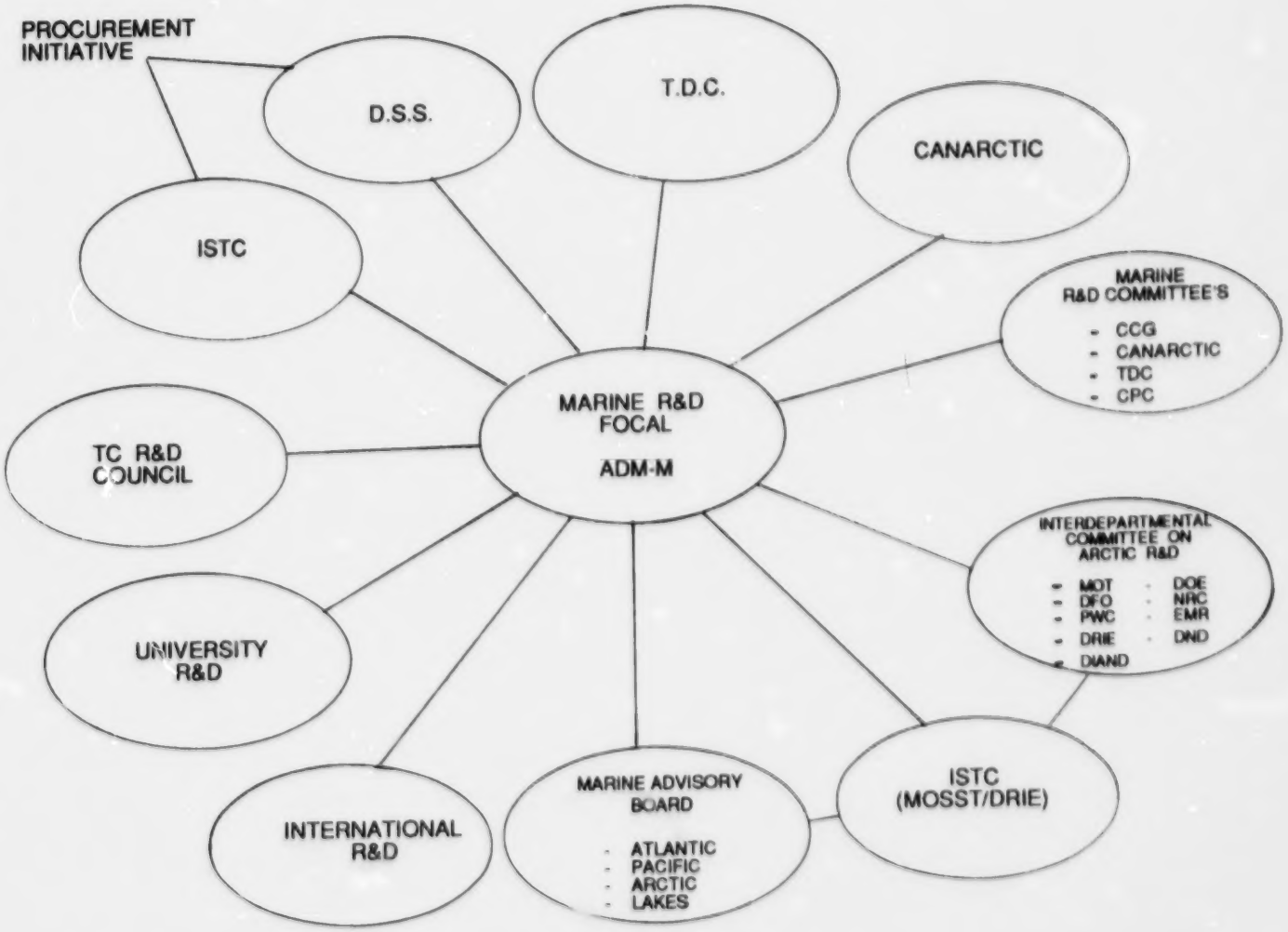
Volume II of the report contains summaries of each project undertaken as part of the COG R&D Program.

In addition it contains a list of reports* which resulted from research projects undertaken in 1988/89.

* The list also appears as Section IV of Volume I.


DEPUTY MINISTER
Assistant Deputy Minister Marine and Commissioner Canadian Coast Guard
Deputy Commissioner Canadian Coast Guard
Director General Newfoundland Region
Director General Maritimes Region
Director General Laurentian Region
Director General Central Region
Director General Western Region
Director General Fleet Systems
Director General Aids & Waterways
Director General Telecommunications & Electronics
Director General Ship Safety
Director General Ports & Harbours
Director Executive Services
Director Resource Management
Director Coast Guard Northern
Director Search & Rescue
Departmental (Canadian Coast Guard)
Corporate
Canarctic Shipping
Atlantic Pilotage Authority
Pacific Pilotage Authority
Laurentian Pilotage Authority
Great Lakes Pilotage Authority
9 Harbour Commissions
Canada Ports Corporation
St. Lawrence Seaway Authority
Seaway International Bridge Corporation
Jacques Cartier & Champlain Bridges Inc.

R&D COORDINATION (MARINE)



SECTION I

SECTION I

TRANSPORT CANADA MARINE GROUP/CCG MISSION

To attend to the development and operation of a safe and efficient national (marine) transport system;

- by providing, or ensuring the provision of, services which facilitate the safe and efficient movement of vessels in Canadian waters;
- by developing an appropriate and timely regulatory base; and
- by coopering with other public and private members of the marine community in order to ensure the safe and economical conduct of marine transportation.

MARINE R&D OBJECTIVES

To undertake R&D in support of Marine Group/CCG operational, regulatory, and procurement objectives.

To contribute to related federal objectives and provide the leadership necessary to ensure that marine transportation R&D activities are coordinated.

To promote and facilitate timely technological innovation in marine transportation and related (marine) industries, contributing to improved safety, efficiency and effectiveness in the marine transportation system.

To work with other federal research centres, provinces, universities and independent research agents to promote marine centres of excellence and to aid in the training of operating personnel, scientists and other professionals in marine matters.

ENVIRONMENTAL OBJECTIVES

The Canadian Coast Guard strives to facilitate the introduction of new technology for tracking and detection, clean-ups, the effects of ships source pollution and spills.

Marine research aimed at improving regulations has some, if not total environmental significance. The safety of the environment and persons has always been a critical priority.

To ensure that all marine pollution issues are reviewed and where appropriate, co-operative remedial action is taken to address them.

PARTICIPATING COAST GUARD BRANCHES AND BRANCH R&D OBJECTIVES

Executive Services:

To provide administrative and coordination services in R&D to other participating branches. To provide liaison with the marine community at large and with specific marine R&D performers.

Fleet Systems:

To improve the operational efficiency of the CCG fleet by developing and examining new technology as well as by collecting data to evaluate operational effectiveness. To acquire and maintain an effective and efficient fleet.

Aids and Waterways:

To ensure that utilization of Canadian waterways and way facilities is not detrimental to public safety, property, or the marine environment.

To increase accessibility of Canadian ice-covered waterways to marine environment.

To foster increased efficiency of the aids operation by reducing operational and maintenance costs.

Ship Safety:

To obtain necessary data for keeping ship safety regulations up-to-date with development in modern technology and for drafting new regulations as necessary.

Telecommunications and Electronics:

To assess the suitability of available telecommunications, electronics, computer and space technology to meet Coast Guard operational and regulatory requirements and those of the marine community.

To assess newly developed systems or equipment, to accomplish necessary pre-engineering, and to monitor and support fundamental technological investigations in electronic circuitry performed by the scientific community and by industry.

(cont'd) ...

Emergencies Branch:

To be proactive in sponsoring the development of state-of-the-art pollution clean-up technologies, rather than relying on existing technology. To sponsor related practical field evaluation work to improve CCG marine emergency response capability. To promote the development of practical projects and sponsor field trials of equipment.

Northern:

To obtain necessary data specific to icebreaking ships operating in the Arctic, in order to keep ship safety regulations up to date. To propose new regulations for developing Arctic technologies.

To continue polar icebreaker R&D related to ship design, its subsystems and basing requirements.

Search and Rescue:

To improve marine operational efficiency in search and rescue activity through the field evaluation of newly developed equipment.

CCG FUNDING SOURCES

Arctic Waters Regulatory Studies Program (AWRSP):

This program was set up in 1986/87 due to the cancellation of the Arctic Marine Transportation R&D Program (AMTRD). The main program objective is to update the Arctic Waters Pollution Prevention Act. Therefore, priority is given to projects addressing regulatory and safety concerns in the Canadian Arctic. Project details can be found under **Appendix A.**

Fleet Capital Investment Plan (FCIP) R&D:

Treasury Board approval for the R&D component of FCIP was obtained in 1985/86; the program commenced in 1986/87. This component is defined as any investigatory, analytical or developmental activity, whether associated with equipment, systems, or personnel that is designated to improve the efficiency or effectiveness of the Fleet Mission. Project details can be found under **Appendix C.**

Regulatory and Engineering Studies (RD&ES) Plan:

The RD&ES Plan was established in 1982/83 to fund feasibility and engineering studies, field service surveys or other such types of applied R&D related projects. Project details are under **Appendix E.**

Energy R&D Program (ER&D):

The federal Energy Research and Development Program began in 1974 under the administration of the Department of Energy, Mines and Resources (Office of Energy R&D). The Panel Process was initiated in 1975 with the establishment of the Panel and OERD. It subsequently underwent two modifications, the first in 1981 when the budget was substantially increased and the second in 1985 when the budget was substantially decreased.

The Program is divided into seven TASKS:

1) Energy Efficiency
2) Coal
3) Fusion
4) Renewable Energy and Generic Environment
5) Alternate Transportation Fuels
6) Oil, Gas and Electricty
7) Co-ordination and International Co-operation

(cont'd) ...

In the marine mode sub-program, the principle ER&D activities have historically been concerned with the transport of energy commodities in particular with the transport of oil and gas from the Arctic and offshore regions. As a result, the Oil, Gas and Electricity (TASK 6) is the most frequent source of funds for the Marine Group/CCG.

The Energy Conservation (TASK 1), the Renewable Energy and Generic Environment (TASK 4) and Alternate Transportation Fuels (TASK 5) are also potential sources of funds for Marine Group components. Project details can be found under **Appendix D.**

DSS Unsolicited Proposals (UPs) Program:

The Department of Supply and Services operates an industrial incentive program whereby private companies may submit unsolicited research and development project proposals via DSS (known as formal unsolicited proposals) for government consideration. The CCG has been an active participant since 1978.

Proposals supported by the Marine Group are financed from the CCG internal R&D programs. Proposals funded or sponsored in 1987/88 are listed in **Appendix F.**

Transport Development Centre (TDC) "A" Base R&D Program:

The mission of the Transportation Development Centre (TDC) is to provide components of Transport Canada with specific data, research and demonstration projects to assist components in their operational, regulatory, policy, planning and evaluation functions, and to undertake exploratory R&D addressing requirements in transportation technology and systems that are high risk, long range and national in scope.

Marine Group components may participate jointly with TDC in the management of R&D projects or may ask TDC to undertake projects on their behalf. Projects undertaken jointly with TDC are included under **Appendix A and C.**

Other Departments:

Every year there are some projects which are jointly funded by several departments. Either Coast Guard supports a project initiated by other departments or we get support for our projects. This occurs when the project results are of direct or indirect benefit to a number of government departments or agencies. Projects are included under **Appendix A, C** and **D.**

SECTION II

1988/89 Program Highlights

SECTION II

1988/89 PROGRAM HIGHLIGHTS

ARCTIC WATER REGULATORY STUDIES PROGRAM (AWRSP):

In 1988/89 the work of the Sub-committees set up to provide industry input to the update of the Canadian Arctic Shipping Pollution Prevention Regulations (CASPPRS) continued. These sub-committees play a major role in the regulatory review process. We believe that their contribution will assist Coast Guard in the smooth introduction of CASPPR revisions.

The research projects undertaken under AWRSP are intended to provide input to the regulatory review process. Major thrust of the 1988/89 program included work on the behaviour of ice in the crushed ice zone to increase the understanding of ship/ice, structure/ice interaction; work on ice regime studies to assist in defining zones and entry dates and to update the ASPEN model database. In addition, research projects related to Arctic lifesaving and survival were undertaken.

FLEET CAPITAL INVESTMENT PLAN (FCIP) R&D:

An ongoing feasibility study for applying ultrasonic testing to monitor pipe system degradation began in 1987/88. If feasible, the technology will provide a quick and non-destructive method of locating problem areas and scheduling repairs to minimize operational impacts.

The design phase of the Arktos Beta, an arctic utility and emergency vehicle was completed. The Development schedule of this vehicle extends over an 18 months period.

CCG completed a project to develop and evaluate a hardware and software system to assess the viability of a local area network (PC's) on a shipboard environment.

RESEARCH & DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES):

Numerous projects intended to improve the safety, efficiency and effectiveness of marine transportation were undertaken under the plan.

Among the subject areas investigated were various means to improve the efficiency of the marine aids operation by reducing equipment maintenance and servicing requirements and improving equipment reliability; and studies to assist in the understanding of fishing vessel stability and MODU stability.

The design of the Coast Guard "Oil Harvester" was also improved and performance trials with the prototype exceeded expectations.

(cont'd) ...

PROGRAM FOR ENERGY RESEARCH AND DEVELOPMENT:

1988/89 saw the completion of Phase V of the Shipboard Ice Navigation Support System (SINSS). Phase V covered the implementation and operational assessment of a first generation SINSS.

SECTION III

SECTION III

FUTURE GOALS:

The Coast Guard research program constitutes a major expenditure in marine transportation research. Its impact extends beyond the immediate objectives of this federal agency. The results are of value to scientists, industry and universities.

A major objective of the CCG is to improve the flow of information on its research results to the marine community at large. This involves the development of policies for the control of sensitive information and the promotion of a more focused information dissemination (or technology transfer) procedure.

1988/89 saw the continuance of the effect to improve the CCG R&D planning process. A longer-term horizon on the operating environment and a five-year specification of direction will assist in promoting continuity in research interests in the face of fluctuating resources.

Also, to improve the planning of federal operational and regulatory research, it is important to improve our communication linkages with industry and the science community. National mechanisms such as the ADVISORY BOARD ON MARINE TRANSPORTATION R&D, and the NATIONAL RESEARCH COUNCIL will continue to play a major role in the review of the CCG R&D program.

The effective solicitation of technologies or knowledge from other countries can also be aided through a well-structured program of international co-operation. The involvement of Canadian industries, consulting firms or universities as performers of the Canadian-side of international research will assist the in-flow of technology and foster joint-venture projects.

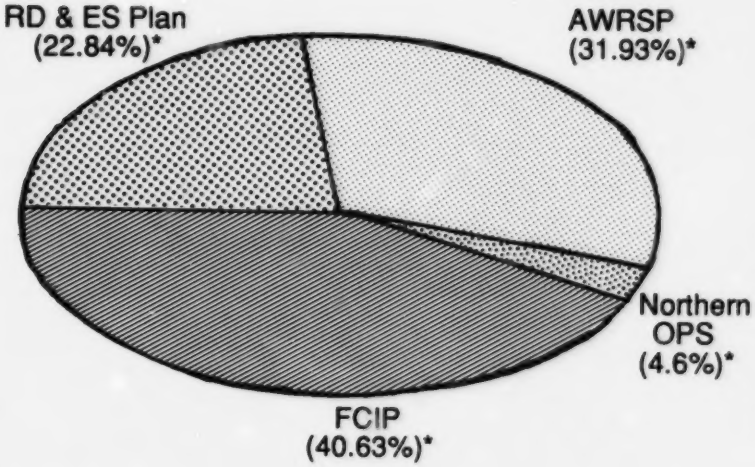
CCG 1988/89 R&D SUMMARY

BY FUNDING SOURCE

FUNDING SOURCE	1988/89 $'000
INTERNAL CCG FUNDING SOURCES	
Research & Development and Engineering Studies (RD&ES) Plan	1,035
Fleet Capital Investment Plan R&D (FCIP R&D)	1,841
Arctic Waters Regulatory Studies Program (AWRSP)	1,447
Northern R&D Operations	208
TOTAL INTERNAL	4,531
EXTERNAL FUNDING SOURCES	
Energy R&D	947
DSS's Contribution Proposals (UP's) Program	267.7
Other Departments (including TDC)	1,615
TOTAL EXTERNAL	2,829.7
TOTAL	7,360.7

CCG 1988/89 R&D PROGRAM SUMMARY BY FUNDING SOURCE

INTERNAL FUNDING SOURCES

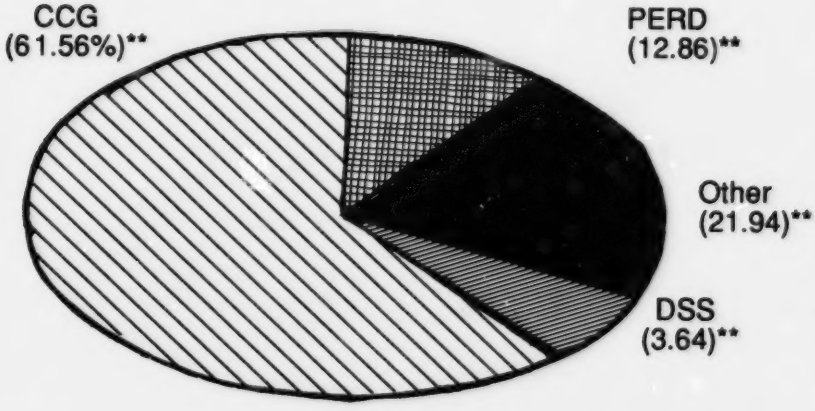


Arctic Waters Regulatory Studies Program (AWRSP)	$1,447K
Northern R&D Operations	$ 208K
Fleet Capital Investment Plan R&D (FCIP R&D)	$1,841K
Research & Development and Engineering Studies Plan (RD&ES) Plan)	$1,035K

* **Percentages are based on $4,531K**

Total: $4,531K

TOTAL FUNDING (INTERNAL AND EXTERNAL)



Coast Guard	$4,531K
Energy R&D (PERD)	$ 947K
Other Departments (including TDC)	$1,615K
DSS UP Program	$267.7K

** **Percentages are based on $7,360.7K**

Total: $7,360.7K

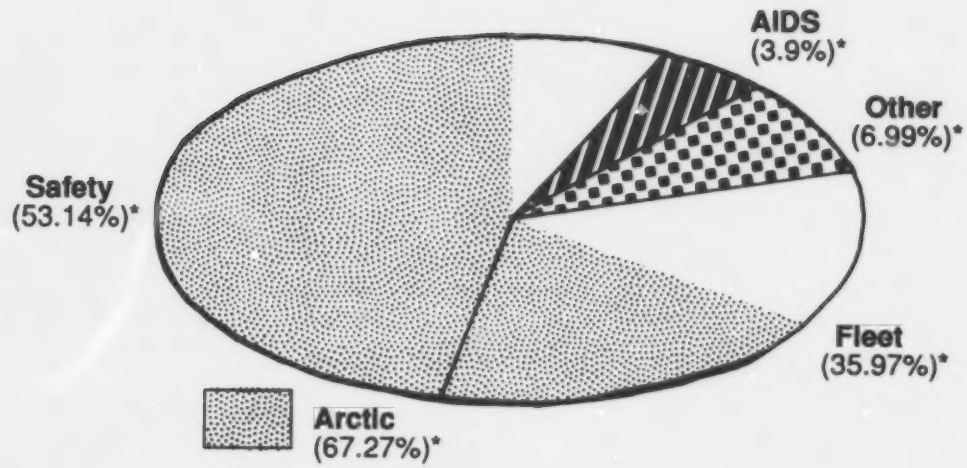
1988/89 CCG R&D PROGRAM - KEY RESULT AREA/SOURCE OF FUNDS

KEY RESULT AREA	AWRSP 000's	CCG INTERNAL FUNDS	FCIP 000's	RD&ES 000's	PERD 000's	DSS UP 000's	OTHER* 000's	TOTAL
Short Range Aids to Navigation	-	-	-	239	-	-	-	239
Safety & Public Correspondence Communications	-	-	-	105	-	-	-	105
Vessel Traffic Services (VTS)	-	-	-	105	-	-	-	105
Waterways Development Maintenance & Protection	-	-	-	164	-	-	-	164
Ship Safety	-	-	-	261	-	-	125	386
Search & Rescue Operations	-	-	-	28	-	-	-	28
Emergencies	-	-	-	133	-	-	-	133
Direction & Administration	-	-	-	-	-	-	-	-
Arctic R&D Safety & Regulatory	1,447	-	-	-	70	-	1,050	2,567
Fleet: Ships	-	-	1,841	-	-	200	170	2,211
Fleet: Aviation	-	-	-	-				
Northern R&D Operations	-	208	-	-	-	-	-	208
TOTAL	1,447	208	1,841	1,035	70	200	1,345	6,146

NOTE: Figures Denote Actual Dollar Expenditures

* **TDC and OTHER DEPARTMENTS/INDUSTRY**

1988/89 RESEARCH & DEVELOPMENT PROGRAM BY CCG THRUST AREA



* **Figures based on total funds of $6,146K**

SAFETY - includes R&D related to Ship Safety, Safety and Public Correspondence Communications Arctic Safety and Regulations, and Northern R&D Operations ($3,266K).

AIDS TO NAVIGATION - includes R&D related to Short Range Aids to Navigation ($239K).

FLEET OPERATIONS - includes R&D which specifically addresses the requirements of Fleet Systems Branch related to either ships or aviation ($2,211K).

OTHER - includes R&D related to Emergencies, Search and Rescue Operations, Waterways Development, Maintenance and Protection, Vessel Traffic Services and Direction and Administration ($430K).

ARCTIC - overlaps the headings above and includes mainly Arctic Safety and Regulatory Research ($2,567K), Northern R&D Operations ($208K) and the Arctic portion of Fleet Operations ($1,360) (Total $4,135)

SECTION IV

SUMMARY OF PROJECT REPORTS

Arctic Waters Regulatory Studies Program

Arctic Research & Development Safety & Regulatory

Project	TP No.	Title
No. 2062	TP 8238	Physical modelling of ship/ice interaction. Technical Research Centre of Finland/Arctec Canada Limited - Dec. 1986
No. 2086	TP 7652	Update of the Arctic SAR database. Fleet Technology Ltd. - August 1988
No. 2087	TP 6329	Damaged stability criteria for vessels operating in the Arctic Shipping control zones. Arctec Canada Ltd.
No. 2091		Canadian Arctic Marine Ice Atlas, Winter 1987/88. Norland Science and Engineering Ltd. - September 1988
No. 2104	TP 9158	Arctic survival equipment tests 1987/88. Melville Shipping Ltd. - March 1988
No. 2139		Arctic Winter Marine Ice Atlas, Winter 1987/88 Phase II, Task I. Canarctic Shipping Co. Ltd. - March 1988
No. 2151	TP 7397	Bent Horn Demonstration project MV Arctic Ice Navigation Support Exercise report 1985. Canarctic Shipping Co. Ltd.

Northern Operations Research & Development

Project	TP No.	Title
No. 2140		Environment Atlas for Lancaster Sound Oil Spill - available Department of Environment (DOE)

Fleet Capital Investment Plan (Ships)

Project	TP No.	Title
No. 2975	TP 9709	Field Assessment of Weld Corrison on the M.V. "Arctic". Centre for Frontier Engineering Research - March 1989

(cont'd) ...

Research and Development and Engineering Studies Plan

Short Range Aid To Navigation

Project	TP No.	Title
No. 2163		Prescott Base Buoy Maintenance Facility Evaluation. Corrspec Consultants Inc.
No. 2180		Executive Summary Report for R&D Project Network re: the Acquisition of hydrographic Data. Michel Bernard. February 1990

Ship Safety

Project	TP No.	Title
No. 2128	TP 9578	Impact of IMO Drug Cargo Vessel Sub-division when applied to Canadian Ships. Fleet Technologies Ltd. - December 1988

Emergencies

Project	TP No.	Title
No. 2224		Tank Testing of Skimmers with waxy & Viscous Oils. S.L. Ross Environmental Research Ltd. Ottawa, Canada. - January 1989

Search and Rescue Operations

Project	TP No.	Title
No. 2132		Evaluation of Ship Location and Reporting Systems. Techwest, Division of Fleet Aerospace - March 1988
No. 2741		Target Detection Experiment-Canso Bank, 1988 - October 1989

Volume

2

Canadian Coast Guard / Garde côtière canadienne

R&D PROJECT REPORT DOCUMENTATION FORM

1. Transport Canada Report No.	2. CCG Project No.	3. Recipient's Catalogue No.
TP 9172 E/F Vol. II		

4. Title and Subtitle	5. Report Date
Canadian Coast Guard Research and Development ANNUAL REPORT 1988/89 - Vol. II	May 31, 1990
	6. Performing Organization Report No. TP 9172 E
7. Author(s) S. P. Ball, Executive Services	8. Transport Canada File No. AMEB 2204 9172
9. Performing Organization Name and Address CCG	10. DSS File No.
	11. DSS or Transport Canada Contract No.
12. Sponsoring Agency Name and Address CCG	13. Type of Report and Period Covered Annual Report 1988/89
	14. Sponsoring Agency Code
15. Supplementary Notes -	16. CCG Project Officer Project Officer

17. Abstract

Annual Report on 1988/89 CCG R&D Activities

VOL. II - Detailed Project Descriptions

18. Key Words	19. Distribution Statement
AWRSP, FCIP,RE&ES, PERD, UP,s	

20. Security Classification (of this report)	21. Security Classification (of this page)	22. No. of Pages	23. Price
Unclassified	N/A	144	N/A

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Canada

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Arctic R&D - Safety & Regulatory

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D.7 Search & Rescue Operations 121
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Proposals Sponsored in Previous Years
- -1988/89 funds allocated

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Summary of Project Reports

VOLUME II

Volume II of the report contains summaries of each project undertaken as part of the COG R&D Program.

In addition it contains a list of reports* which resulted from research projects undertaken in 1988/89.

* The list also appears as Section IV of Volume I.

APPENDIX A

ARCTIC WATERS REGULATORY STUDIES PROGRAM

(AWRSP)

ARCTIC - RESEARCH AND DEVELOPMENT

APPENDIX A

1988/89 ARCTIC WATERS REGULATORY STUDIES PROGRAM

KEY RESULT AREA AND SOURCE OF FUNDS

KEY RESULT AREA	AWRSP 000's	TDC 000's	OTHER* 000's	TOTAL
Arctic Research & Development - Safety and Regulatory	1,447	200	920	2,567

* Other is:

PERD	-	70K	for project 2082
NRC	-	70K	for project 2082
		(20K	for project 2155)
AMS	-	50K	for project 2104
INDUSTRY	-	450K	for project 2155
NSERC	-	260K	for project 2155

ARCTIC WATERS REGULATORY STUDIES PROGRAM
PROJECT LIST

KEY RESULT AREA: Arctic Research & Development Safety & Regulatory

Project #	Project Title	88/89 expenditures 000's
2045	Hull Structure Temperature - AC Ships	30
2061 -1 -2	Regulatory Updates Sub-committee on Hull Structures Training and Certification	251
2062	Ship/Ice Ramming Physical Models	185
2065	ASPEN Structural Modelling	62
2066	Arctic Structures Corrosion	35
2073	ASPEN Database Maintenance	30
2082	Investigation of Ice Failure Criteria	49
2086	Arctic Search & Rescue (SAR) Requirements	1
2087	Stability - Intact and Damaged	60
2091	Ground Verification Survey for SAR Imagery - Ice Atlas - Winter 87/88	95
2092	Minimum Power Requirements	45
2104	Arctic Survival Equipment	57
2139	Arctic Winter Atlas 1987/88	204
2151	Ice Regions - Trafficability	205
2155	Medium Scale Field Identor Test Program	110
2448	Ice Loads and Framing Design	28
	TOTAL	1,447

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2045 - Hull Structure Temperatures - AC Ships

STATUS: COMPLETED

KEY RESULT AREA: Arctic R&D

PROJECT OFFICER: C. Norris (AMN) (613) 991-6002

CONTRACTOR/PERFORMER: Reltec Advisory Services Inc.

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2045	-	30	-	30

PROJECT DESCRIPTION:

The objective of this work was to obtain experimental data concerning the relationship between ambient conditions & steel temperatures in an arctic marine structure. The database collected provides valuable source information for determining minimum design temperatures.

REPORTS/DELIVERABLES: Experimental Design Temperature Data Base for Arctic Shipping

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

This project demonstrated the feasibility of obtaining data using stand alone acquisition equipment.

Imperature is an important environmental factor for the selection materials when designing against brittle structure. This project was motivated by the need to provide a realistic basis for the minimum design temperature definition to be incorporated in the update of the Canadian Arctic Shipping Pollution Prevention Regulations.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2061 - Regulatory Updates
- Sub-committees Hull Structures
- Training & Certification

STATUS: Report sub-committee on structures was not finished. Further work necessary in 1989/90

KEY RESULT AREA: Marine Regulatory Ship Safety

PROJECT OFFICER: J.S. McCallum (AMN) (613) 991-6001

CONTRACTOR/PERFORMER: Fleet Technology Ltd.

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2061	-	251	-	251

PROJECT DESCRIPTION:

The objective of the Sub-committee on Structures was to finish several tasks necessary to finish their deliberations and report to Coast Guard. The Tripping & Buckling problem turned out to be particularly difficult. Members of the sub-committee prepared drafts of what became chapters of the report. These drafts led to further debate which caused delay such that the draft report was not ready by the end of the F/Y.

The sub-committee on Training & Certification was to formed to consider what expertise is required on board ships in Arctic waters, what training is necessary and which personnel should be qualified.

The complex technical nature of the work with many open ended problems tended to make finalizing of the proposals difficult. Also the committee members who are scattered across the country occupy responsible positions in government & industry such that it was difficult to arrange meetings etc. Due to the transfer of the scientific authority/chairman of the sub-committee on training and certification in February 1989 the work of that committee stopped pending a replacement.

(cont'd) ...

REPORTS/DELIVERABLES: Report: Strength & Stability of Framing for Ice Strengthening
Strengthening Daley Ferregut TP 9157E
Composed of several papers to become chapters of the report. Report now (Sept. 89) in draft TP 9981 two models Held by AMNB
Report included with material for Task #3
Minutes

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

While the proposed amendments to ASPPR which will be the content of the sub-committee are directed towards regulation - ship safety they contain the essence of all the R & D work done since 1972 into ship/ice interaction and ice navigation. The influence on Arctic ship design will be significant while the changes in the control of Arctic navigation will be beneficial to the industry. The training and qualification of crews will be needed if Marine Transportation is to develop in the Arctic.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2062 - Ship/Ice Ramming Physical Models

STATUS: ONGOING - Draft Final report under review. The joint JRPA report is awaited.

KEY RESULT AREA: Marine Regulatory Ship Safety

PROJECT OFFICER: J.S. McCallum (AMN) (613) 991-6001

CONTRACTOR/PERFORMER: Fleet Technology Ltd.

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2062	-	185K	50K	235K

PROJECT DESCRIPTION:

Under JRPA #3 and this project physical models of the M.V. Arctic, Kigoriak and a two generic large tankers have been constructed and extensively tested in model basins. The model ice was synthetic and represented infinite multi-year ice floes. The full scale behaviour of the M.V. Arctic and the Kigoriak have been successfully reproduced and a large measure of understanding of the ramming process has been gained.

It was intended to be the last phase of the physical modelling project be completed in 1987/88. Under this project Canada's share of the work in Joint Research Arrangement #3 with Finland is done. The project has been considerably delayed by technical difficulties such that at the time of writing (Sept. 1989) the draft final report has just been received.

REPORTS/DELIVERABLES: Milestone Reports

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The results of the work have been directly used in the development of proposals for the update of the ASPP Regulations. Also the BAFFIN mathematical ship ice interaction ramming model has been developed and calibrated from this work. BAFFIN has been used in ship design studies including one on POLAR 8. Parts of JRPA #5 with Finland are based on this work.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2065 - ASPEN Structural Modelling

STATUS: ONGOING

KEY RESULT AREA: Icebreaking & Arctic Operations - key result area, Arctic Research & development - Marine Regulatory - Ship Safety

PROJECT OFFICER: A.L. Hart (AMN) (613) 991-6005

CONTRACTOR/PERFORMER: Fleet Technology Ltd.

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2065	-	62K	100K	162K

PROJECT DESCRIPTION:

This project took the previous ASPEN (Arctic Shipping Probability Evaluation Network) model and utilizing the existing data structure for the environment, incorporated modern methods of structural analysis to simulate mathematically the response of the bow portion of a ship structure under ice loads to further develop a probabilistic model which gives the probability of failure of the structure by mechanisms such as tripping and buckling, rather than simple elastic failure.

REPORTS/DELIVERABLES:

- Report on Task 1
- Draft Final report
- Preliminary computer model for testing and verification

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The principal benefit of this work is the ability to test the suitability of a ship structure to navigate in extended season operation without previously exposing the ship to the risk of actually transiting the region under investigation. Consequently, the risk of pollution can be controlled by understanding the level of risk and applying suitable mitigative measures.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2066 - Arctic Structures Corrosion

STATUS: ONGOING

KEY RESULT AREA: Arctic R & D and Ship Safety

PROJECT OFFICER: A.L. Hart (AMN) (613) 991-6005

CONTRACTOR/PERFORMER: T.D.C. managed - F.G. Bercha

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2066	-	35K	100K	135K

PROJECT DESCRIPTION:

This project was to examine samples of corrosion from both commercial and Coast Guard ships to develop criteria for acceptance of corrosion defects.

REPORTS/DELIVERABLES: - Letter of agreement with TDC

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

This work was promoted by industry from the UP program, there has been an increase in the understanding of the problems related.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2073 - ASPEN Database Maintenance

STATUS: Work extended into 1989/90

KEY RESULT AREA: Arctic Research and Development

PROJECT OFFICER: A.L. Hart (AMN) (613) 991-6005

CONTRACTOR/PERFORMER: D.F. Dickens Associates Limited

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2073	-	30K	30K	60K

PROJECT DESCRIPTION:

This project was to take the previous ASPEN (Arctic Shipping Probability Evaluation Network) model database review it and then update it.

REPORTS/DELIVERABLES:
- Reports on Database review
- Final revised database for all ASPEN calls

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The result of this work, is the ability to test the suitability of a ship structure to navigate in ice without exposing the ship to the risk of actually transiting the region under investigation using a current and documented ice database.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2082 - Investigation of Ice Failure Criteria

STATUS: Ongoing

KEY RESULT AREA: Arctic Research and Development

PROJECT OFFICER: J.S. McCullum (AMN) (613) 991-6001

CONTRACTOR/PERFORMER: NRC - Institute for Research in Construction

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2082	92	49	-	141
PERD	64	70	-	134K
NRC	-	70	-	70K

PROJECT DESCRIPTION:

This study will investigate the mechanisms involved in the ice crushing part of the process of structure/ice or ship/ice interaction during impact in order to better understand and more accurately quantify the associated forces.

There will be particular effort put into quantitative measurements of the whole impact process with an emphasis on the behaviour of the crushed ice zone.

REPORTS/DELIVERABLES:
- Interim Progress Reports
- Analysis of Propeller Ice Impact Loads

INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY:

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2086 - Arctic Search & Rescue (SAR) Requirements

STATUS: COMPLETED

KEY RESULT AREA: Arctic Research and Development

PROJECT OFFICER: M. Dempster

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2086	26	1	Ø	27

PROJECT DESCRIPTION:

To evaluate requirements for SAR equipment necessary in the Arctic, and the suitability of existing equipment in low temperatures.

REPORTS/DELIVERABLES:

Recommendations with respect to changes in the current regulatory requirements, survival requirements and procedures, and SAR capability and ability.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Results will be of value to all companies operating in the Arctic. Suppliers and manufacturers of lifesaving and survival equipment may benefit from increased sales and development of new equipment.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2087 - Stability - Intact and Damaged

STATUS: ONGOING

KEY RESULT AREA: Arctic Research and Development

PROJECT OFFICER: V.M. Santos-Pedro (AMN) (613) 991-6004

CONTRACTOR/PERFORMER: National Research Council of Canada

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2087	-	60K	200K	260K

PROJECT DESCRIPTION:

Carry out experiments in model ice basins to examine ice rubble pileups against fixed inclined planes and floating models of intact and damaged ships. Rubble dimensions, forces, moments and stresses will be measured. Full scale data from Gulf Canada will be used to verify modelling results. An analytical model that can predict rubble dimensions and forces against various ships will be developed. The results will lead to improved confidence in using model ice to simulate full scale ice behaviour.

REPORTS/DELIVERABLES: N/A at this time.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

By developing standards for stability and freeboard for ships and offshore structures operating in the Arctic, the design, reliability and efficiency can be optimized.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2091 - Ground Verification Survey for SAR Imagery - Ice Atlas - Winter 87/88

STATUS: COMPLETED - Actual on-ice data obtained for inclusion in 1987/88 Winter Ice Atlas.

KEY RESULT AREA: Arctic Research and Development

PROJECT OFFICER: A.L. Hart (AMN) (613) 991-6005

CONTRACTOR/PERFORMER: Canarctic Shipping Co. Ltd.

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2091	133K	95K	-	228K

PROJECT DESCRIPTION:

This project was to ground truth certain of the areas that were to be incorporated into an atlas of the ice environment of the Canadian Arctic.

REPORTS/DELIVERABLES: Final report (available on loan from AMN)

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

There are a variety of spin-off benefits from this work, the principle one is the furtherance of the Canadian claim that the waters of the Northwest passage are internal waters of Canada, and not an international strait. The technological benefits are in the promotion of the advanced ice radar technology used by Interra to obtain the basic information, and the development of the skills for the interpretation of this information.

Future benefits are in the prospect of improved ability in the forecast of ice conditions.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2092 - Minimum Power Requirements

STATUS: ONGOING

KEY RESULT AREA: Arctic R & D

PROJECT OFFICER: C. Norris (AMN) (613) 991-6002

CONTRACTOR/PERFORMER: T.D.C. managed - Melville Shipping

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2092	-	45K	150K	195K

(Delegated budget 50K, no forecast)

PROJECT DESCRIPTION:

- Determine parameters affecting power (thrust) levels.
- Propose changes to regulations
- Validate changes

REPORTS/DELIVERABLES: Design and Development of an Analytical Propeller/Ice Interaction Model: PR88-06

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Not available at this time.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2104 - Arctic Survival Equipment

STATUS: ONGOING

KEY RESULT AREA: Arctic Research & Development

PROJECT OFFICER: C. Norris (AMN) (613) 991-6002

CONTRACTOR/PERFORMER: The CORD Group Limited

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2104	-	57K	100K	157K
AMS	-	50K	155K	205K

PROJECT DESCRIPTION:

The cold environment, ice conditions, and remoteness of the Arctic shipping routes from search and rescue capabilities engender a requirement for self sufficiency beyond that required in other waters. Previous work has evaluated in part the suitability of available equipment, regulatory and otherwise. Some recommendations have come out of this work, which requires further analysis to determine the economic impact and relative suitability of equipment.

Recent developments in life-saving or rescue vehicles need to be further evaluated.

There are presently no specific survival training or medical requirements for crew on vessels operating in the Arctic. This area is required to be examined to determine if such requirements should be made.

Subsequent work has indicated a requirement for a type of interpretation manual for seamen or otherwise to identify ice information.

REPORTS/DELIVERABLES: -

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Results will be of value to all companies operating in the Arctic. Suppliers and manufacturers of lifesaving and survival equipment may benefit from increased sales and development of new equipment.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2139 - Arctic Winter Atlas 1978/88

STATUS: ONGOING

KEY RESULT AREA: Arctic Research and Development Ship Safety

PROJECT OFFICER: A.L. Hart (AMN) (613) 991-6005

CONTRACTOR/PERFORMER: Canarctic Shipping Co. Ltd.

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2139	-	204K	90K	294K

PROJECT DESCRIPTION:

This project is to produce an Atlas of the Ice conditions in the Canadian Arctic essentially for the winter of 1987/88, with additional data included from the previous edition.

REPORTS/DELIVERABLES: N/A at this time.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The project was put in place in preparation for demands for increased shipping operations in the Arctic; especially in those periods at the beginning and ends of the present ship operational season. Knowledge of the winter ice environment aids in an understanding of the spring break up patterns, for use in forecasting ship operations.

There are a variety of other spin-off benefits from this work, the principle one is the furtherance of the Canadian claim that the waters of the Northwest passage are internal waters of Canada, and not an international strait. The technological benefits are in the promotion of the advanced ice radar technology used by Interra to obtain the basic information, and the development of the skills for the interpretation of this information.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2151 - Ice Regions - Trafficability

STATUS: Completed - the trial of the ice regime system in the Eastern Arctic only

KEY RESULT AREA: Arctic Research and Development

PROJECT OFFICER: A.L. Hart (AMN) (613) 991-6001

CONTRACTOR/PERFORMER: Canarctic Shipping Co. Ltd.

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2151	-	205K	-	205K

PROJECT DESCRIPTION:

This project was to on an experimental basis test the ice regime system being developed for revised ship entry into the Arctic Shipping Safety Control Zones, in a real basis on board ships in the Eastern and Western Arctic.

REPORTS/DELIVERABLES: -

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The ultimate benefit of this work will be improved control of shipping and risk to the environment in the Arctic.

The interface between the present AES ice information chart and the projected system were trailed on a real time basis for the development of the final product.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2155 - Medium Scale Field Indentor Test Program

STATUS: ONGOING

KEY RESULT AREA: Icebreaking & Northern Operations

PROJECT OFFICER: J.S. McCallum (AMN) (613) 991-6001

CONTRACTOR/PERFORMER: Mar, Gestech, NRC

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2155	Ø	110	150	260
TDC	Ø	200	Ø	200
PERD	Ø	Ø	202	202
NSERC	Ø	260	Ø	260
INDUSTRY	Ø	450	200	650
NRC	Ø	20	100	120

PROJECT DESCRIPTION:

1. To achieve an improved understanding of the local forces generated during the interaction between structures and large ice features.
2. To carry out field tests to investigate indentation forces, pressures and displacements for ice/structure contact areas up to $3m^2$ and for indentation speeds approaching 1m/s.
3. Emphasis to be placed on characterizing the failure/damage process in the ice.
4. Various ice types to be investigated.

REPORTS/DELIVERABLES: -

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

1. The definition of local indentation forces generated by ice will reduce the uncertainties in the safe and economic design of offshore structures and ships. The results of the work will have application both to design and regulation.
2. NRC will play a coordinating role in bringing together university, industry and government to achieve a common technical goal.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2448 - Ice Loads and Framing Design

STATUS: COMPLETED

KEY RESULT AREA: Icebreaking and Northern Operations

PROJECT OFFICER: J.S. McCullum (AMN) (613) 991-6001

CONTRACTOR/PERFORMER: German & Milne

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2448	-	28	-	28

PROJECT DESCRIPTION:

By means of a physical model and CAD computer equipment, develop a method for establishing the frame line relationship to the ice load from the information normally given on the usual drawings submitted for the approval of an ice class ship design.

The work will also include the establishment of the angles between the web of the frame and the shell.

The proposed revisions to the ASPPR will be used but the outcome will be applicable to other rules.

REPORTS/DELIVERABLES:

User friendly software probably for use on Transport Canada IBM or VAX computers for use in approving complex structural drawings of ice class ships.

A detailed report showing the basic trigonometric calculations and logic.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The opportunity is to greatly improve and facilitate the assessment of ship structural designs. Also this can lead to greatly improved designs and methods.

APPENDIX B

NORTHERN OPERATIONS RESEARCH & DEVELOPMENT

APPENDIX B

1988/89 NORTHERN OPERATIONS RESEARCH & DEVELOPMENT

KEY RESULT AREA AND SOURCE OF FUNDS

KEY RESULT AREA	AWRSP 000's	TDC 000's	DSS UP 000's	OTHER 000's	TOTAL
Northern Operations Research & Development	208	-	-	-	208

NORTHERN OPERATIONS RESEARCH & DEVELOPMENT

PROJECT LIST

Project #	Project Title	88/89 expenditures 000's
2067	Marine Access to Northern Sites	158
2140	Environment Atlas for Lancaster Sound Oil Spill Response	10
2141	LINEX-CCGV Study of APS-504	40
	TOTAL	208

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2067 - Marine Access to Northern Sites

STATUS: ONGOING

KEY RESULT AREA: Arctic R&D

PROJECT OFFICER: Capt. Toomey (AMND) (613) 991-6012

CONTRACTOR/PERFORMER: Polar Sea Research Ltd. & Norland Science & Engineering Ltd.

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2067	-	158	42	200

PROJECT DESCRIPTION:

The "Polar 8" icebreaker will be operating year-round in Arctic waters and will be sailing in areas hitherto inaccessible to shipping. Much of the information required to navigate in these areas safely is available, but not collected into a useful format or summarized so as to be useful to a navigator. It is intended that this project will produce a form of "Pilot Book" for High Arctic navigation to cover areas not adequately described in - or missing from - the current literature.

REPORTS/DELIVERABLES:

A final report on each Project. Final report of each working paper.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: -

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2140 - Environmental Atlas for Lancaster Sound Oil Spill Response

STATUS: COMPLETED

KEY RESULT AREA: Route Assistance Through Ice - Infested Waters: Lancaster Sound, Northwest Territories, Canada

PROJECT OFFICER: D. John (AMND) (613) 998-6574

CONTRACTOR/PERFORMER: D.F. Dickins

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2140	-	10	-	10

PROJECT DESCRIPTION:

The work will consist of developing a Marine Environmental Atlas of the Lancaster Sound Area.

REPORTS/DELIVERABLES:

Environmental Altas for Lancaster Sound Oil Spill Response.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: Develop an Environmental Data Base

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2141 - Evaluation of the Litton APS-504 (V5) Radar as an Ice Classification Sensor

STATUS: COMPLETED

KEY RESULT AREA: Ice Surveillance Equipment Supporting Polar 8 Operations

PROJECT OFFICER: Stephen Buckles (AMN) (613) 990-8783

CONTRACTOR/PERFORMER: D.F. Dickins

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP - 2141	-	40	-	40

PROJECT DESCRIPTION:

Several aircraft equipped with remote sensing equipment will be involved in the LIMEX-89 experiment scheduled to start Mar. 12, 1989. These include the AES Electra equipped with a Passive Microwave Radiometer (PMR) and Side Looking Airborne Radar (SLAR), the Canadian Centre for Remote Sensing Convair equipped with a Synthetic Aperture Radar (SAR), and the Atlantic Airways King Air equipped with the Litton radar.

They will be conducting ice classification test flights over a two year period in co-ordination with the CCG icebreaker Sir John Franklin.

The Litton APS-504(V5) radar is an effective helicopter borne search radar that has been used by the Canadian Navy for a number of years. An evaluation of the radar by Atlantic Airways published in a paper entitled "Integrated Aerial Surveillance System Designed for Ice Management in the Marginal Ice Zone" provides some information on the usefulness of the radar for ice type classification.

The plan is to take advantage of the exercise by collecting imagery from the Litton radar at the same time as the other to be used to evaluate the Litton radar as an ice classification sensor.

If the experiment is considered a success, the follow-on activity would be to make a design and cost evaluation of the use of the Litton radar as a helicopter borne SAR for Polar 8 tactical ice classification.

(cont'd) ...

REPORTS/DELIVERABLES:

Data Summary Report - ice maps, search radar maps.

**INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY:**

This experiment will provide a relatively inexpensive opportunity to assess the Litton radar as an ice classification sensor.

The follow-on activities that could evolve from the experiment could provide substantial savings in the development of helicopter borne ice classification sensors.

The funds are available as part of the Polar 8 Operations and Research allotment and the aircraft will be available during the exercise.

APPENDIX C

FLEET CAPITAL INVESTMENT PLAN

(FCIP)

APPENDIX C

1989/89 FLEET CAPITAL INVESTMENT PLAN

KEY RESULT AREA AND SOURCE OF FUNDS

KEY RESULT AREA	FCIP 000's	TDC 000's	EMR 000's	DSS UP 000's	OTHER* 000's	TOTAL
Fleet: Ships	1,841	125	10	200	35	2,211
Fleet: Aviation	-	-	-	-	-	-

* Wagner Engineering Limited - 35K for Project 2501
DSS - 200K for Project 2501
EMR - 10K for Project 2927
TDC - 125K for Project 2980

APPENDIX C-1

FLEET CAPITAL INVESTMENT PLAN

(FCIP)

FLEET CAPITAL INVESTMENT PLAN R&D

PROJECT LIST

KEY RESULT AREA: Fleet Capital Investment Plan - Ships

Project #	Project Title	88/89 expenditures 000's
2501	Develop & Incorporate New Technology on Marine Controllable Pitch Propellers	1
2509	Computer Assist Learning for Sea Going Personnel	6
2925	Feasibility Study of Applying Ultrasonic Testing to Monitor Pipe System Degradation	62
2927	Study of the Effect of Weld Metal Composition on its Seawater Corrosion Resistance and Toughness	28
2928	Arctic Utility & Emergency Vehicle	1,300
2938	Datahail Communication Network	40
2939	Ice Flow & Blockage Investigation of Shrouded Propellers	20
2943	Bilingual Computerized Maintenance Program	236
2952	Effect on Welding Process and Parameters on Weldability of Selected Primers	51
2970	In-Situ Weld Repair of Internals to Shell Plating in Ice Transiting Ships	18
2971	Fundamental Study of Thermal Sprayed Metal Coating for Control of Corrosion	34
2975	Weld Corrosion Assessment - MV Arctic	20
2978	Martha L. Black - Local Area Network	24
2980	Hull Forms in Ice, Phase I	1
	TOTAL	1,841

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2501 - Develop & Incorporate New Technology on Marine Controllable Pitch Propellers

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: E.W. Street (AMF) (613) 998-1784

CONTRACTOR/PERFORMER: Wagner Eng. Ltd., Can-Dive Services Ltd., Arctic Research Development

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	-	1	53	54
DSS	100	200	-	300
Wagner Eng. Ltd.	50	35	-	135

PROJECT DESCRIPTION:

The program to develop and field test a C.P.P. system with the above mentioned features will be carried out as follows:

- Incorporation and shop testing of special features for underwater removal and modifications to strengthen the propeller hub for icebreaker application (produce test components, shop tests, etc.).
- Complete pre-production engineering and shop and pre-launch tests of the propeller system (arrangement drawings, dismantling and inspection after testing, etc.).
- Underwater removal and replacement of the propeller hub assembly (procedure evaluation, summary and report).

REPORTS/DELIVERABLES: NONE AT THIS TIME

(cont'd) ...

**INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY:**

The development of the underwater replacement capability could make this C.P.P. the standard for icebreakers and other vessels working in hazardous waters. The export potential is excellent because the modular format of the C.P.P. makes it technically feasible for the high tech components, PROPELLER HUB, OIL TRANSFER UNIT and the PROPELLER BLADES to be produced in Canada, while the heavier and less technically critical TAILSHAFT is produced in the shipbuilding country. Hence the cost of the C.P.P. is significally reduced. Once the underwater replacement capability is demonstrated as viable, it can be incorporated in our standard C.P.P. models. It is also noticed that the underwater replacement feature will have application in vessels other than those working in ice conditions.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2509 - Computer Assisted Learning for Sea Going Personnel

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: R. Theefom (AMS) (613) 991-5692

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TBC
FCIP	-	6	40 (91/92)	46

PROJECT DESCRIPTION:

Phase 1 - to trail the use of generic training programs aboard to determine the effectiveness of computer training aboard ship.

Phase 2 - to develop a computer-based bilingual program in an operation particular to Coast Guard's unique program needs which can be used to improve the level of overall capability in that operation. The exact subject of the training program has not yet been determined or its limits defined. Several subjects which appear to be relevant at the present time are operator fault finding and operational training on the machinery control systems aboard FCIP acquire ships, and risk management in buoy-laying or damage control. The result of this subject phase could also be used as part of the Electrical Officer training program or the Command Course.

The Phase 2 project would be in three distinct steps as follows:

Step I - Determination of enabling objectives and producing lesson plans of proposed training and assessing its ability to be effectively taught by the computer based training method.

(cont'd) ...

Step II - Production of the training program is an acceptable format and completely compatible with the hardware aboard Coast Guard ships.

Step III - Evaluation of the training program aboard operational Coast Guard ships.

REPORTS/DELIVERABLES: -

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

There is virtually no scientific opportunity attached to this proposal. However, we will be using the Computer Based Learning Centre, recently established at the Transport Canada Training Institute to assist with this project.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2925 - Feasibility Study of Applying Ultrasonic Testing to Monitors Pipe System Degradation

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: L.D. Parkinson (AMF) (613) 998-1777

CONTRACTOR/PERFORMER: CCG Maritimes Region/NDE - Quantum Inspection Services

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	1	62	10	73

PROJECT DESCRIPTION:

The elements of this pilot project have been divided into ten (10) tasks, which are listed as follows:

1. Determination of Test Point Locations
2. Definition of System Checkpoint Parameters
3. Selection of Ultrasonic Test Instrumentation and Associated Computer System
4. Procurement of Ultrasonic Test Instrumentation and Computer System
5. Development and Documentation of Ultrasonic Test Specifications and Techniques
6. Implementation of Ultrasonic Testing Aboard a newly acquisitioned Type 1100 vessel in Maritimes Region
7. Training of Regional Engineering Personnel in the Use of Ultrasonic Test Techniques
8. Monitoring and Verification of Ultrasonic Test Program
9. Production of Interim Reports
10. Production of a final report indicating the feasibility for fleet application.

(cont'd) ...

REPORTS/DELIVERABLES:

A detailed study report on the feasibility of monitoring pipe systems degradation using ultrasonic thickness test instrumentation.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

This pilot project will lead to the formation of a report illustrating the feasibility of implementing ultrasonic thickness test methods to monitor pipe system degradation, and allow the transfer of this technology to other government agencies.

No undue business or financial risk is foreseen as the work objectives are well defined and all test procedures are standard in nature.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2927 - Study of the Effect of Weld Metal Composition on its Seawater Corrosion Resistance and Toughness

STATUS: COMPLETED

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: L.D. Parkinson (613) 998-1777

CONTRACTOR/PERFORMER: EMP/PMRL (CANMET)

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	-	28	-	28
EMR	10	10	-	20
DSS	37.7	-	-	37.7

PROJECT DESCRIPTION:

This project proposes the analysis of specific chemical elements in weld metal deposits to establish the criterion for the development of new Canadian manufactured welding electrodes with improved sea water corrosion resistance and adequate toughness for use by Fleet, and other ship owner/ operators, when specifying new construction performance requirements and repair.

A series of conventional Canadian manufactured welding electrodes and a series of experimental welding electrodes shall be used to join a single based steel (EH 36 modified) to provide a systematic investigation of weld metal composition on it's corrosion resistance and notch toughness. The alloying elements to be studied are manganese (Mn), Nickel (Ni), Copper (Cu), Silicon (Si) and Titanium-Boron (Ti-B). Two welding processes shall be used.

REPORTS/DELIVERABLES: A detailed Study Report.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

No undue business or financial risk is foreseen as the work objectives are well defined and all test procedures are standard in nature.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2928 - Arctic Utility & Emergency Vehicle

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships & Safety

PROJECT OFFICER: Victor Bennett (AMF) (613) 998-6849

CONTRACTOR/PERFORMER: WATERCRAFT OFFSHORE CANADA LTD.

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	448	1,300	109	1,857

PROJECT DESCRIPTION:

The Company will develop the followings:

- Preliminary design,
- Components of system research,
- Detailed design,
- Hull and deck construction,
- Components fabrication & purchase,
- Components sub-assembly,
- Components and sub-assembly testing.

During the above all drawings will have by be approved by Ship Safety to ensure the vehicle will comply as close as reasonably possible with STANDARD FOR LIFEBOATS 1987 - TP 7320.

This vehicle Development schedule should extends over a 18 month period.

REPORTS/DELIVERABLES: -

(cont'd) ...

**INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY:**

The delivered vehicle will be a 100% Canadian product that has unmatched abilities and may have potential for export markets.

The new technology developed for this vehicle to operate in extreme arctic conditions is an important step in research and development of arctic safety and transportation systems. The vehicle has commercial applications for oil exploration and other arctic operations (possibly military and servicing radar and air defence systems) and could become a leader on the national and international market.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2938 - Datahail Communication Network

STATUS: COMPLETED

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: R. Renaud (AMF) (613)

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	Ø	40	Ø	40

PROJECT DESCRIPTION:

Acquisition of 3 Data Hail Network Controllers from Ultimate East Data Communications Ltd., Newfoundland. Acquisition of 3 personal computers - Compaq Model 3. The intended test vehicle is CCGS Mary Hichens. A personal computer will be interfaced with an existing SSB radio transceiver using a Data Hail Network Controller. At Coast Guard Radio station Yarmouth and Sydney, personal computers will be interfaced with the existing Radio Operations Consoles using the Data Hail Network Controller. A third land station using an existing personal computer at Ice Operations Halifax may be included in the development phase. Upon installation of the above apparatus, operational personnel will use the system to exchange a variety of messages. Evaluations regarding; information exchange rate, range, simplicity of operation, reliability, etc. will be compiled.

REPORTS/DELIVERABLES:

This new facet of communication/computer technology has yet to be used in an operational scenario by Coast Guard. The R&D project "HF Air/Ship Position Exchange Communication System" or "PXCS", will utilize similar principles to provide helicopter position up-dates for Fleet vessels. When Coast Guard vessels are fitted with computers to assist in the administration of

(cont'd) ...

budgets and materials, the same computer may be used in conjunction with an existing HF radio to exchange hard-copy messages. Information which is time-sensitive, such as SARS data, could be transferred to regional offices for immediate processing.

In its present form, the Data Hail Network Controller will provide an alternative to expensive INMARSAT hard copy communications by developing the potential of the existing marine terrestrial communications network.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The Global Marine Distress and Safety System, GMDSS, proposals may include a requirement for MF/HF radioteletype. The Data Hail Network Controller could provide an inexpensive equivalency which is acceptable from both an operational/functional and a regulatory point of view. The Data Hail Network Controller is manufactured by Ultimate East Data Communications Ltd. of Newfoundland and is a product of Canadian research.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2939 - Ice Flow & Blockage Investigation of Shrouded Propellers

STATUS: COMPLETED

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: P. Semery (TDC)

CONTRACTOR/PERFORMER: Arctic Research and Development Ltd., Nordes Ltd., Institute for Marine Dynamics

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	-	20	-	20

PROJECT DESCRIPTION:

The work will be conducted by ARCTIC RESEARCH AND DEVELOPMENT LTD. in cooperation with NORDCO LTD. and the INSTITUTE FOR MARINE DYNAMICS of St-John's, Newfoundland. The proposal is to study ice pieces flow as well as the influence of different parameters (size of ice blocks, ship speed and draft, etc.) on the suction forces of the nozzle to finally develop and test a blockage from a shrouded propulsion system.

Initial testing will be performed in a model test set-up using a towing tank and existing simulated ice fragments designed with regards to all available information on blockage and will be using instrumentation, model and simulated ice blocks (plywood/wood) realized by Nordco and IMD. The proposed model is the M.V. Arctic at a scale of 1:30. After analysis of the results the modified design will be tested in the same model test set-up.

Cameras, above and under the waterline, will be used to register the paths of the ice blocks. The forces acting on the ice blocks and on the nozzle will be measured using strain gauges and the torque and thrust of the shaft using standard equipment.

(cont'd) ...

The tests will be carried out at IMD/NRC/MUN and has a total schedule of 10 months (40 weeks) required. Time necessary for the execution of model tests has already been reserved at IMD.

REPORTS/DELIVERABLES: -

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

If the modified design redeems itself as being effective, World Wide interest should arise due to the numerous Arctic vessels in use internationally in various fields. Therefore, the project being completely Canadian, would surely benefit the Canadian industry.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2943 - Bilingual Computerized Maintenance Program

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: J.G.P. St. Pierre (AMN) (613) 990-6369

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	-	236	7	243

PROJECT DESCRIPTION:

It is proposed to issue a contract for developing a bilingual computerized system which involves a program transformation into French from the existing English version of the MMP and installation on board CCGS Sir Wilfred Laurier.

REPORTS/DELIVERABLES:

- FLOPPY DISKS - equipment index, equipment spare parts
- Book of equipment index
- Book of equipment spare parts

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

1. The project is assessed as a low risk of completing within the allotted time and budget.

2. Some risk may occur during the project implementation such as delays caused by government departments which will result in penalty clauses being invoked that have not been assessed in the cost.

(cont'd) ...

Those to be aware of are:

1) Vessel availability at scheduled times
2) Delays in processing contracts
3) Delays in hardware delivery
4) Suppliers not meeting deadlines

3. The proposed hardware as specified in Section 7 paragraph 1.4 could pose a slight risk, in that, the 80386 processor has not been used on a CCG vessel to date and may not function correctly in a shipboard environment. IBM hardware has been used by CCG vessels in the past and is performing to expectations, therefore, the risk is considered minimal.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2952 - "Effect of Welding Process and Parameters on Weldability of Selected Primers"

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: L.D. Parkinson (AMF) (613) 998-1777

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	51	51	17	119
EMR	15	-	-	15
DSS	25	-	-	25

PROJECT DESCRIPTION:

The project will be performed in two phases:

Phase 'A'

A series of three main paint types shall be tested. These include inorganics, epoxies and vinyls. Each is available as a single or plural component material with a variety of pigment types.

The completed samples will be subjected to radiography. A total of 12 Hydrogen and hardness tests shall be selected. An interim report shall be submitted to the Scientific Authority, which will form the ground work for Phase "B".

Phase 'B'

A series of eight groove welds and twenty fillet weld tests shall be selected based on the results of Phase "A". The precise matrix for these will be decided after consultation with the Scientific Authority and include the following tests: Visual Inspection, Radiographic Inspection, Reduced Section Tensile Tests, Hardness Tests, CVN Toughness Tests, Hydrogen Measurements, Fracture and Macroexamination.

(cont'd) ...

Lloyds GR EH 36 Steel will be used. For groove welds, S.A.W. with square butt joints, and S.M.A.W. with single vee edge preparations. For each, four qualification tests will be carried out employing the highest, medium and lowest rated weldable primers from Phase "A" along with no primer condition as reference. For fillet welds, five combinations of process, consumable and heat input in conjunction with the three primers.

REPORTS/DELIVERABLES:

A detailed study report on the effects of primers on weld metal under various welding shall be provided.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

No undue business or financial risk is foreseen as the work objectives are well defined and all test procedures are standard in nature.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2970 - In-Situ Weld Repair of Internals to Shell Plating in Ice Transiting Ships

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: L.D. Parkinson (AMF) (613) 998-1777

CONTRACTOR/PERFORMER: Materials Technology Centre

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	-	18	128	146

PROJECT DESCRIPTION:

The elements of this project have been divided into six tasks, as follows:

Task 1: Cooling Rate Estimate

The key requirement is to assess the effect of particular ambient conditions for tripping damage repair on the cooling rates of fillet welds.

Task 2: Establishing the Repair Environment

Task 3: Development of Welding Procedures

After completion of Tasks 1 and 2, a meeting between the contractor and the CCG Project Officer will be held to discuss the development of welding procedures based on the results reached in the preceding tasks.

(cont'd) ...

Task 4: Procurement of Steels and Welding Consumables, and Weldability Tests

The objective of this task will be to verify the cooling rates estimated in Task 1, and the welding procedure recommendations of Task 3.

Task 5: Welding Specification

Once the first four tasks have been completed, the contractor will produce a welding specification for in-situ weld repair of internals to shell joints, such that the vessel is fit for a return to dock, or for further operational duties, as necessary.

Task 6: Final Report

REPORTS/DELIVERABLES:

A final report will be submitted by the contractor to the CCG Project Officer describing the outputs of the various tasks and will include the finalized welding specification.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The Study offers a new and unique concept of repairing damage to internals attached to the shell envelope of ice transiting ships, in-situ or dockside, versus escorting and/or towing a ship from a remote location, such as the arctic, to a dry dock which has the capacity for a lift of this nature. The results are feasible to attain and if successful, the information gained will be extremely beneficial to Canadian Coast Guard, private sector ship owner/operators, ship building and ship repair industry and the technical committees of CSA Standard W59/AWS D1.1. There are no foreseen scientific risks as the laboratory tests are standard in nature and the work statements are of adequate detail.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2971 - Fundamental Study of Thermal Sprayed Metal Coatings for Control of Corrosion

STATUS: COMPLETED

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: L.D. Parkinson (AMF) (613) 998-1777

CONTRACTOR/PERFORMER: Energy, Marine & Resources

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	50	34	-	84

PROJECT DESCRIPTION:

The elements of this study have been divided into two phases with specific tasks for each phase as follows:

Phase 'A' - Acquisition of Technical Data

Task 1: Literature Search

The first task of Phase 'A' will be to initiate an extensive literature search to locate "state of the art" technical data on the application, corrosion characteristics, metal usages, as well as the performance of thermal sprayed metal coatings with various sealant and top coat paint systems, including any other pertinent data on the subject as it relates to the marine environment.

Task 2: Technology Transfer/S.I.M.A. Station, San Diego

The second task of Phase 'A' will involve liaising very closely with the U.S. Naval Shore Intermediate Maintenance Activity (S.I.M.A.) Station in San Diego, California to acquire further technical and economic data.

(cont'd) ...

Phase 'B' - Acquisition of Economic Data

Task 1: Nationwide Survey of Thermal Spray Facilities

The first task of Phase 'B' will be to initiate a survey of thermal spray facilities and their capabilities in Canada.

Task 2: Economic Study

The second task of Phase 'B' will establish the relative costs versus service life of paint systems utilizing a thermal sprayed coating as compared to conventional primers.

Task 3: Final Report

REPORTS/DELIVERABLES:

A final report summarizing the findings of Phases 'A' and 'B'.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The study will lead to the formation of a report outlining the feasibility of implementing thermally sprayed metal coatings as a means of corrosion control and will allow the transfer of this technology to other governments.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2975 - Weld Corrosion Assessment - MV Arctic

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: L. Parkinson (AMF) (613) 998-1777

CONTRACTOR/PERFORMER: Centre for Frontier Engineering Research

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	61	20	30	111

PROJECT DESCRIPTION:

The MV Arctic Weld Corrosion Study is a four(4) year program designed to monitor real time corrosion characteristics of welds located in the shell envelope of Ice Transiting Ships. The program is also intended to correlate actual in service corrosion rates with laboratory prediction methods such as synthetic seawater tank testing, anodic dissolution tests and potentiastatic polarization tests.

During the MV Arctic's new bow installation and hull modifications at Port Weller Dry Docks in 1985/86 a series of five(5) weld metal compositions were deposited on the ships hull in selected locations; joining three(3) grades of shipbuilding steels. When applying the low friction coating each zone (approximately 1 metre in length) was masked to ice abrasion and, cold (1°C) highly oxigenated (~20ppm) seawater during the three year field assessment monitoring period.

Upon completion of the original work program the contractor was asked to submit a proposal to extend the monitoring phase for an additional two years. The extension would include one field inspection per year in Montreal, Quebec.

(cont'd) ...

REPORTS/DELIVERABLES:

1) Field Inspection Reports
2) Interim Report Summarizing the first two years - February 1987
3) Final Report - March 1990

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The knowledge developed will find direct application in the fabrication of icebreakers, second generation cargo ships and offshore production platforms.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2978 - Martha L. Black - Local Area Network

STATUS: COMPLETED

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: R. Zadra (CGVP-F)

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	13	24	-	37

PROJECT DESCRIPTION:

The project will be to link 4 micro-computer work stations (1 IBM AT's, 2 IBM PC's, and 1 Compaq Portable PC) in a multi-user local area network using the "IBM Network". The portable computer will be transportable between various locations.

A number of applications will be phased in accordance with regional priorities, it is anticipated that several "off the shelf" software packages will be run on the system, including LOTUS 1-2-3, dBaseIII, SAMNA, mathematics training software, and other applications as they become available.

At the end of the project an evaluation will be produced to assess any problems encountered, and the viability of a local area network on a ship-board environment.

More specifically this project will address the following two R&D components:

a) Hardware testing on board ship - very little is known about how PC's will react in a Coast Guard ship environment, including equipment suitability given climatic, and electrical power conditions, as well as shock and vibration onboard ship.

(cont'd) ...

b) Micro-computer Ship Ergonomics - almost no information is available on machine/user interface on board ships. Substantial analysis and trials need to be done to determine optimal equipment location, as well as networking and installation.

REPORTS/DELIVERABLES:

A complete assessment of the viability of different types of hardware in the same conditions.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The pilot project will address future needs for local area networks on board CCG ships and associated risks. In particular the project will assess hardware durability, and the ergonomic aspect of computers on CCG ships.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2980 - Hull Forms In Ice, Phase I

STATUS: ONGOING

KEY RESULT AREA: Fleet: Ships

PROJECT OFFICER: J. Connell (AMF) (613) 998-1775

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
FCIP	23	1	155	179
TDC	-	125	-	125

PROJECT DESCRIPTION:

To develop a computer program for the definition of improved ice-breaking bows.

To use the new program to develop alternative bow forms for five existing CCG ice-going vessels and to analyze their performance.

To develop an optimal ice-breaking bow shape for each vessel.

To expand the performance prediction model to deal with:

- astern motion in level ice.
- unconventional low shapes (e.g. Waas).
- To draw up a suitable program of physical model tests.

REPORTS/DELIVERABLES:

A comprehensive report describing the project and containing full technical support for both computer programs.

A user manual and program disk for each program.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The potential benefits will relate to the efficiency of all new CCG icebreakers and ice-going vessels. Substantial savings in capital and O&M costs are possible.

The benefits may extend to existing vessels through modernization.

APPENDIX C-2

FLEET CAPITAL INVESTMENT PLAN

(AVIATION)

FLEET CAPITAL INVESTMENT PLAN R&D

PROJECT LIST

KEY RESULT AREA: Fleet Capital Investment Plan - Aviation

Project #	Project Title	88/89 expenditures 000's
-	-	-

APPENDIX D

RESEARCH & DEVELOPMENT AND ENGINEERING STUDIES PLAN

(RD&ES)

APPENDIX D

1988/89 RESEARCH & DEVELOPMENT AND ENGINEERING STUDIES PLAN

KEY RESULT AREA AND SOURCE OF FUNDS

KEY RESULT AREA	RD&ES PLAN 000's	TDC 000's	DSS UP 000's	OTHER 000's	TOTAL
Short Range Aid To Navigation	239	-	-	-	239
Ship Safety	261	-	-	125	386
Safety & Public Correspondence Communications	105	-	-	-	105
Vessel Traffic Services	105	-	-	-	105
Emergencies	133	-	-	-	133
Waterways Development Maintenance & Protection	164	-	-	-	164
Search & Rescue Operations	28	-	-	-	28
Direction & Administration	-	-	-	-	-
	1,035	-	-	125	1,160

* CANMET, DEVCO COAL - 100K for Project 2165
  DFO/DOF - 25K for Project 2783

* Western Region Contributed 41K to Project 2148

APPENDIX D-1

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

SHORT RANGE AIDS TO NAVIGATION

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

PROJECT LIST

KEY RESULT AREA: Short Range Aids to Navigation

Project #	Project Title	88/89 expenditures 000's
2109	Review of Buoy Cleaning & Painting Facilities & Practices	23
2144	Ice Forces on Structures	17
2148	Development of Lightweight Buoys	47
2150	Yamachiche Ice Force Measuring System	4
2159	Thrash Chains in Mooring Systems	5
2163	Prototype Buoy Cleaning and Painting Equipment	63
2178	Power Conditioning	4
2237	Griffith Island, N.W.T. Arctic Test Station	19
2268	Development of Testing of High Performance Coating System for Buoys	17
2321	RACON Improvements	11
2325	Satellite Navigation	9
2423	Determination of Drag Coefficient for Buoys	1
2768	VBB Ice Force - Structures	19
	TOTAL	239

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2109 - Review of Buoy Cleaning & Painting Facilities & Practices

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: D.A. Long (AMA) (613) 998-1392

CONTRACTOR/PERFORMER: Correspec Consultants Inc.

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	12	23	10	45

PROJECT DESCRIPTION:

To review the existing Coast Guard facilities available for the cleaning and painting of buoys and to recommend changes necessary to bring these facilities up to current health and safety standards and to enable the use of new, high performance, buoy paints.

REPORTS/DELIVERABLES:

The consultant produced reports on the assessment of the facilities at each District in the Maritimes Region.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: NONE

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2144 - Ice Forces on Structures

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: T.P. Hodgson (AMA) (613) 998-1407

CONTRACTOR/PERFORMER: National Research Council, various contractors suppliers

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	40	17	42	99

PROJECT DESCRIPTION:

To determine the maximum likely value of ice force on lightpier type structures with a view to modifying the design loads used on these structures.

REPORTS/DELIVERABLES:

a) VBB: Report No. M7334, set of five reports, Ice Forces Against Offshore Structures

b) Yamachiche: Ice Forces on Yamachiche Bend Lightpier, winters 1983/84 to 1988/89.

c) Ice Force Ontario: Report due by February 1990.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: NONE

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2148 - Development of Lightweight Buoys

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: Reiner Silberhorn (AMA) (613) 998-1411

CONTRACTOR/PERFORMER: Gilman Corporation, B.C. Research

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES - Western Region	Ø	41	20	61
Headquarters	152	6	90	218

PROJECT DESCRIPTION:

To develop new buoys which will be easier to handle and have a longer life.

REPORTS/DELIVERABLES: NONE

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: NONE

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2150 - Yamachiche Ice Force Measuring System

STATUS: COMPLETED

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: T.P. Hodgson (AMA) (613) 998-1407

CONTRACTOR/PERFORMER: N.R.C.

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	246	4	Ø	250

PROJECT DESCRIPTION:

1.	Redesign of electronic system.	Completed
2.	Purchase of new system.	Completed
3.	Modification of ice force panels.	Completed
4.	Installation and calibration.	Completed. Annual calibration.
5.	Operation over five years.	Four years operation completed by 1987/88.
6.	Installation of add on panel.	Completed in 1985.

REPORTS/DELIVERABLES:

Physical ice force measuring system. Data on ice forces during winter of 1983-84, 1984-85, 1985-86 and 1986-87. Reports available.

Report for 1987/88 is anticipated.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Knowledge sharing with scientific community; technical papers will be written and presented at conferences. IALA Ice Force Technical Committee has prepared design code. Paper was presented at Canadian Coastal Conference in August 1985. Paper was presented at 8th International Symposium on Ice sponsored by IAHR in August 1986. Other conference papers are planned.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2159 - Thrash Chains In Mooring Systems

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: Reiner Silberhorn (AMA) (613) 998-1411

CONTRACTOR/PERFORMER: Whiteman Benn (Halifax)

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	1	63	200	264

PROJECT DESCRIPTION:

To investigate the wear and life span of various lengths of thrash chain in the mooring system of 9'-6" buoys.

REPORTS/DELIVERABLES:

The first report (literature and analysis) was received in March 1989. Future reports will be received after every inspection trip.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: NONE

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2163 - Prototype Buoy Cleaning and Painting Equipment

STATUS: COMPLETED

KEY RESULT AREA: Short Range Aids to Navigation

PROJECT OFFICER: D.A. Long (AMA) (613) 998-1392

CONTRACTOR/PERFORMER: Mr. Sullivan & Son Limited
Correspec Consultants Incorporation
Wheelabrator Corporation of Canada Limited

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	398	5	Ø	403

PROJECT DESCRIPTION:

Evaluate new state-of-the-art buoy cleaning and painting equipment at Prescott Base in order to prepare specifications for a standard installation from which equipment may be selected to modernize buoy maintenance buildings at other CCG bases.

REPORTS/DELIVERABLES: -

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The results of the evaluation of the new equipment in the application of new paint systems will be of benefit to the marine coating industry.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2178 - Power Conditioning

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: T.P. Hodgson (AMA) (613) 998-1407

CONTRACTOR/PERFORMER: Integrated Power Inc.

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	4	29	33

PROJECT DESCRIPTION:

For the purpose of effectiveness and availability in operating aids to marine navigation, sometimes AC equipment is exclusively used. In remote locations, AC power supply is unavailable. It is necessary that the DC power supply from photovoltaic systems be transformed to AC power. The duty of the power conditioning unit is strictly for low AC power consumption equipment.

REPORTS/DELIVERABLES:

An intern laboratory report will be issued when testing is finished in March 1990.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: NONE

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2237 - Griffith Island, N.W.T. Arctic Test Station

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: C. Myers (AMA) (613) 998-1407

CONTRACTOR/PERFORMER: Narwhal (Resolute Bay) Mechron

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	19	50	69

PROJECT DESCRIPTION:

To develop and test a low wattage diesel generator cycle charge system for use in the Arctic.

REPORTS/DELIVERABLES:

Reports have been prepared periodically. A final report will be prepared by March 1990.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

1. This research will give Canadian manufacturers the opportunity to consider new uses and applications for their products. For instance durable low maintenance modular buildings developed for use at lightstations may also be of interest to other government departments or the private sector.

2. The research will be done in cooperation with the regions manufacturers, consultants and the NRC.

3. Risks are nil.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2268 - Development of Testing of High Performance Coating System for Buoys

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: D.A. Long (AMA) (613) 998-1392

CONTRACTOR/PERFORMER: Correspec Consultants Inc.

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TBC
RD&ES	192	17	73	282

PROJECT DESCRIPTION:

To develop and test new high performance paint systems for buoys.

REPORTS/DELIVERABLES:

Following each annual inspection of the test systems, the Consultant submits reports on his findings and recommendations.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The suppliers of the products being tested could benefit from the test results being achieved.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2321 -- RACON Improvements

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids To Navigation

PROJECT OFFICER: J. Scollick (AMT) (613) 998-1544

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	123	11	20	154

PROJECT DESCRIPTION:

The immediate task is evaluation of a new low-cost RACON by Tidelands Corporation. This project may involve purchase of one unit for long-term evaluation. In future years, methods of reducing both RACON sensitivity and power output for short range applications such as bridge pier marking, in order to improve RACON response definition, will be evaluated. The ITOFAR technique requires a minor modification to the ship radar display system which would also have to be evaluated and modification procedures developed. Specialized test equipment will also be assessed.

To conduct laboratory evaluation of the new Frequency Agile RACONs, from various manufacturers, to investigate new RACON maintenance equipment and procedures and to evaluate techniques for further improvements in definition of the RACON response when used for bridge pier marking. Additionally, a new ITOFAR (Integrated Time Offset Frequency Agile RACON), a technique developed by a Swedish RACON manufacturer, may be evaluated.

(cont'd) ...

REPORTS/DELIVERABLES:

(a) Integrated X/S-Band RACON test sets for Regional Maintenance depots;

(b) Evaluation of new generation of RACONs;

(c) Evaluation of special RACON test equipment;

(d) Evaluation report on bridge pier marking improvements; and

(e) Evaluation of ITOFAR and ship radar display modification report (not yet approved).

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

(a) Anticipated Benefits

- mission related equipment, improved identification of landfalls, danger areas, etc. by ship radar.

(b) Plan to Achieve Industrial Product or Technology Transfer

- equipment not manufactured in Canada.

(c) Risks

- technical risks are minimum.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2325 - Satellite Navigation

STATUS: ONGOING

KEY RESULT AREA: LR NAVAID

PROJECT OFFICER: I. Ginsburg (AMT) (613) 998-1554

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	196	9	75	280

PROJECT DESCRIPTION:

As GPS progresses towards operational status CCG will:

- Monitor the market and developments of GPS receivers, differential GPS (DGPS) processors, communications links and systems, and user display and control systems.
- Monitor the GPS development activities of other agencies, e.g., United States Coast Guard, DGPS R&D project.
- Provide technical advice as required on GPS systems. At present, we participate in an interdepartmental steering group for a DRIE sponsored GPS receivers development by CMC.
- Participate in intra and interdepartmental and international groups concerned with GPS. At present, we are members of the NACCSM Sub-Committee on "GPS Applications in Canada" and "RTCM SC 104" on DGPS broadcast standards.
- Study GPS and receiver operation. At present, we own and operate two Trimble GPS receivers.

(cont'd) ...

- Monitor and participate, where useful in the GPS evaluation activities of other Departments, particularly CHS and Geodetic Survey.

- Arrange and coordinate GPS/DGPS equipment and systems evaluation specifically for the floating NAVAID positioning application.

REPORTS/DELIVERABLES:

Reports on GPS/DGPS activities when appropriate. Canadian Coast Guard has received reports from contracted GPS experiments on board ship in 1983 and a trial of non-realtime DGPS on a Bell 206 helicopter for floating aids position checking in 1984. These reports were summarized for Canadian Coast Guard senior management.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

(a) Anticipated Benefits

- mission related equipment, procedures and knowledge.

(b) Plan to Achieve Industrial Product or Technology Transfer

- regular technical meetings with Canadian Marconi Co. on development of a civil GPS receiver and DGPS receiver;
- contract work with NORTECH surveys of Calgary; and
- advice to equipment and systems manufacturers regards technical suitability for Canadian Coast Guard applications.

(c) Risks

- technical only and diminishing.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2423 - Determination of Drag Coefficient for Buoys

STATUS: ONGOING

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: R. Silberhorn (AMA) (613) 998-1411

CONTRACTOR/PERFORMER: N/A

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	25	1	34	60

PROJECT DESCRIPTION:

To determine the drag coefficients of existing buoys by experiment and to develop a theory for the calculation of drag coefficients for future buoys.

REPORTS/DELIVERABLES: NONE

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

If a general method could be derived this could prove useful in the hydrodynamic design of buoys.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2768 - VBB Ice Force - Structures

STATUS: COMPLETED

KEY RESULT AREA: Short Range Aids

PROJECT OFFICER: T.P. Hodgson (AMA) (613) 998-1407

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	44	19	Ø	63

PROJECT DESCRIPTION:

The work involves the instrumentation of an existing pier in the Baltic Sea. Results from the action of ice on the pier will enable the research team to determine the magnitude of the ice force on piers.

REPORTS/DELIVERABLES:

There will be accelerated output of information relating to ice forces on piers. It is considered that current design codes specify too high ice pressures. If new information leads to a change in codes, then fixed aids will be less costly.

Reports will be available quarterly and at the end of each major task.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The Ice Pressuremeter Technique developed by CCG was used in the 1986/87 Winter season and will be used in the 1987/88 season.

APPENDIX D-2

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

SHIP SAFETY

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

PROJECT LIST

KEY RESULT AREA: Ship Safety

Project #	Project Title	88/89 expenditures 000's
2128	Introduction to Computer Program Analyses	49
2135	Fire Testing of GRP Panels	2
2165	Biological Control of Methane in Coal Mines, Coal Silor and Ship Holds	35
2202	Cargo Handling Procedures, Gears and Equipment	50
2205	Inventory of Reception Facilities for Marine Wastes in Canada	40
2254	Development of an Inflatable Liferaft Suitable for Vessels making Voyages in Severe Winter Conditions	25
2282	Fishing Vessel Stability in a Seaway - Phase II - Analysis	50
2783	Problems of Plastic Debris & Fishnets	3
2786	MODU Stability Study - Phase II	6
2787	Fatigue Damage Assessment of Partial Penetration Deck Edge/Sheerstrake Connection as Fitted on Board a Canadian Ocean-going Bulk Carrier	1
	TOTAL	261

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2128 - Introduction to Computer Program Analyses

STATUS: ONGOING

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: J. Archibald (AMS) (613) 991-3177

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	13	49	145	207

PROJECT DESCRIPTION:

The project will be carried out in three phases as follows:

Phase I - Existing programs will be researched for applicability and compatibility with Ship Safety computer equipment.

Phase II - Suitable programs will be analyzed and adapted to meet Ship Safety needs.

Phase III - Where no program can be found to meet a particular Ship Safety requirement new programs will be developed.

REPORTS/DELIVERABLES:

Computer programs relating to the survivability of ships and offshore structures will be developed. It is anticipated that these programs will cover many aspects of design analysis not now available to Ship Safety surveyors, such as structural finite element analysis and dynamic stability calculations.

(cont'd) ...

**INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY:**

Programs would be developed basically for use by Ship Safety in the course of developing new regulations and standards for ultimately approving the design of ships and offshore structures. Industry would benefit from increased margins of safety afforded by the more thorough computer analysis of ship designs. There might also be benefits to industry as a result of possible revisions which could be less demanding than current regulatory requirements.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2135 - Fire Testing of GRP Panels

STATUS: COMPLETED

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: J. Howes (AMS) (613) 991-3178

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TBC
RD&ES	Ø	2	Ø	2

PROJECT DESCRIPTION:

NRC will undertake specific fully-documented laboratory tests for B-class rating of serveral GRP panels commonly used in the construction of small fishing vessels. Full test result data and a video-tape of each test will be produced.

REPORTS/DELIVERABLES:

Video-tape of test results, with all accompanying data/documentation.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Feedback to industry for improvement of product where weaknesses identified.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2165 - Biological Control of Methane in Coal Mines, Coal Silos and Ship Holds

STATUS: ONGOING

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: -

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	150	35	65	250
CANMET, DEVCO COAL	348.75	100	100	548.75

PROJECT DESCRIPTION:

A feasibility study has been completed and work is underway on the project. The project involves determining methane concentrations and emissions in various coals, testing methods of reducing these emissions, testing the applicability of these methods for use at the coal mine or onboard the vessel, and eventual field testing by measuring the concentration of methane in a cargo hold.

REPORTS/DELIVERABLES:

Evaluation of the effectiveness of a method for reducing methane emissions from coal, report on the applicability to shipboard use, and recommendations on any regulatory update required.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

This project involves the development of a new methane reduction method for large scale use in coal mines and for onboard ships.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2202 - Cargo Handling Procedures, Gears and Equipment

STATUS: ONGOING

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: R. Lanteigne (AMS) (613) 991-3131

CONTRACTOR/PERFORMER: Various Firms

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	50	80	130

PROJECT DESCRIPTION:

- Establish acceptable sampling and testing methods for bulk cargoes.
- Performance of various tests on lifting appliances' components to establish maximum wear limits.
- Establishment of safer methods respecting cargo loading and transport.

REPORTS/DELIVERABLES:

Evaluation of the effectiveness of the proposed methods and findings and if needed, modifications to our regulatory requirements.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The projects involved:

- The establishment, drafting and presentation of more reliable methods related to cargo handling and transport.
- The preparation of appropriate test pieces and jig work.
- The testing of various components in a suitable and properly calibrated machine.
- The assessment of the results by professional engineers.
- The preparation of reports suitable for presentation to international or national organizations.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2205 - Inventory of Reception Facilities for Marine Wastes in Canada

STATUS: ONGOING

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: D. Ross (AMS) (613) 991-3023

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	40	40	80

PROJECT DESCRIPTION:

- Collection and verification of detailed data including capacities, fees, notification and access requirements, for every reception facility required to handle wastes from ships.
- Documentation of any existing plans for future development of these facilities.
- Analysis of the adequacy of facilities in the context of international agreements to which Canada is a party.
  (Detailed work statement to be developed)

REPORTS/DELIVERABLES:

- A directory of all port reception facilities in Canada equipped to handle oil, chemical, sewage and garbage wastes from ships, along with any plans for future construction or provision of these facilities.
- A report assessing the adequacy of reported or planned waste reception facilities to meet national and international criteria.

(cont'd) ...

**INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY:**

- Having ready access (via their shipping agent) to a valid directory will encourage mariners to use shore-based facilities more regularly and to abide by regulations governing their use.

- Increased demand for these facilities will encourage operators and port authorities to construct new and more suitable amenities and to develop new and efficient waste disposal technologies.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2254 - Development of an Inflatable Liferaft Suitable for Vessels making Voyages in Severe Winter Conditions

STATUS: ONGOING

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: S.J.W. Stewart (AMS) (613) 998-0664

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	25	50	75

PROJECT DESCRIPTION:

1. Development of a design specification.
2. Design of an inflation system.
3. Design of an insulated liner (esp. floor)
4. Assembly of inflation systems.
5. Manufacture and assembly of insulated liner, cold chamber testing.
6. Cold chamber testing of liferafts fitted with inflation systems and liners.

REPORTS/DELIVERABLES:

Submission of interim/progress reports.
Submission of final/reports.
Development of draft standards.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

As exploitation of resources in regions which experience severe winter conditions progresses, survival equipment requirements will become manifest creating a need for this type of equipment. Export opportunities exist within other Northern hemisphere countries engaged in related activities. Industry representatives will form part of management team.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2282 - Fishing Vessel Stability in a Seaway - Phase II - Analysis

STATUS: COMPLETED

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: C.B. Wallace (AMS) (613) 998-0595

CONTRACTOR/PERFORMER: Institute for Marine Dynamics

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	146	50	Ø	196

PROJECT DESCRIPTION:

Work in Phase II involves the following:

1) Analysis of SSPA Test Data

   The test data obtained from capsizing tests in Sweden were delivered in a basic form. The data will be analyzed to give the hydrodynamic forces and moments acting on the model in waves, the motion characteristics of the model, the correlation between the position of the model in waves and the forces and moments acting, and the kinematics of the motions.

2) Development of Theoretical Model

   Computer software will be developed for the computation of hydrodynamic forces in the time domain. This is fundamental to the numerical simulation of capsize events.

3) Capsizing Data Base

(cont'd) ...

The collection of data on existing fishing vessels.

Work in 1987/88 will involve the development of the theoretical model of ship capsizing in quartering seas as follows:

1) Captive model tests - experimental investigation of hydrodynamic forces acting on a ship in breaking waves with deck edge immersed in water.

2) Development of computer software for time domain simulation of motions and capsizing in extreme waves.

REPORTS/DELIVERABLES:

Mathematical models of the stability of fishing vessels will be developed.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

New design standards for fishing vessels may result.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2783 - Problems of Plastic Debris & Fishnets

STATUS: ONGOING

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: T. Fleck (AMS) (613) 991-3166

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	3	5	8
DFO/DOE	27.5	25	Ø	52.5

PROJECT DESCRIPTION:

The contractor will:

Phase 1: conduct an overview of the state-of-the-art;
Phase 2: plan and conduct a workshop;
Phase 3: report on the workshop and make recommendations for action.
DFO contracting action.

REPORTS/DELIVERABLES:

Report and recommendations to ICO.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Possible technologies/development strategies to address the problem.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2786 - MODU Stability Study - Phase II

STATUS: COMPLETED

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: B. Smyth (AMS) (613) 998-0653

CONTRACTOR/PERFORMER: American Bureau of Shipping (ABS)

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	27	6	Ø	33

PROJECT DESCRIPTION:

Further investigation of the critical areas identified by the Phase I study (an analysis of the stability and motion characteristics of semi-submersible MODU's to determine the adequacy of current stability requirements) and others which are necessary for verifying the analytical predictions and for determining a clear trend in stability requirements.

Also, the evaluation of the existing criteria and further model testing including mooring effects are proposed.

REPORTS/DELIVERABLES:

Final report on project completion (might be restricted if it conflicts with export control agreements).

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Any new CCG standards resulting from this study will be distributed worldwide.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2787 - Fatigue Damage Assessment of Partial Penetration Deck Edge/Sheerstrake Connection as Fitted on Board a Canadian Ocean-going Bulk Carrier

STATUS: ONGOING

KEY RESULT AREA: Ship Safety

PROJECT OFFICER: T.G.W. Brown (AMS) (613) 991-3159

CONTRACTOR/PERFORMER: Welding Institute of Canada and British Marine Technology

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES				

PROJECT DESCRIPTION:

It is proposed to divide the project into 3 phases. The work to date has identified areas of concern regarding the operating lifetime expectancy (fatigue damage) of the deck edge connection. Each future phase will have the specific objective of establishing a higher level of confidence in the long term certification of the vessel and will provide a review stage to decide if further work is appropriate.

If phases 1 and 2 identify quantitative doubt as to the long term certification by Ship Safety of the vessel for full ocean-going service, then phase 3 will require the active participation of owner and shipbuilder.

(cont'd) ...

REPORTS/DELIVERABLES:

The output from the work to date and the anticipated output from Phases 1 and 2 will be in the form of discussion documents for distribution to concerned parties. The Phase 1 report shall contain all relevant material and references and shall make a critical review of the analysis of both Demand and Capability models. The assumptions and inherent estimations therein shall be identified and reviewed.

Phase 2 shall produce data on the fatigue capability of partial penetration weldments. Work to date has been unable to identify any such published data. This work shall readily correlate to the Demand model of Phase 1 and provide a rigorous capability model by which to assess Phase 1 and if necessary Phase 3.

Phase 3 will call upon state of the art technology to perform the most rigorous lifetime expectancy simulation available. This work would be of international significance.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The shipyard utilized this type of weldment as an economy measure and has expressed a desire to continue utilizing partial penetration weldment in such critical positions as deck edge ship side connections. Such a connection is crucial to the survivability and seaworthiness of the vessel. This vessel is a large ocean-going bulk carrier also capable of navigating the Great Lakes. It is a Canadian flag vessel for which Ship Safety has responsibility to certify as seaworthy in accordance with international and domestic regulatory requirements.

APPENDIX D-3

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

SAFETY & PUBLIC CORRESPONDENCE COMMUNICATION

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

PROJECT LIST

KEY RESULT AREA: Safety & Public Correspondence Communication

Project #	Project Title	88/89 expenditures 000's
2179	Digital Selective Calling HF & MF	61
2446	Remote Maintenance Monitoring System (RMMS)	44
	TOTAL	105

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2179 - Digital Selective Calling HF & MF

STATUS: ONGOING

KEY RESULT AREA: Safety & Public Correspondence

PROJECT OFFICER: K. Khan (AMT) (613) 998-1530

CONTRACTOR/PERFORMER: Nautical Electronics, Compuphile, Canadian Marconi

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	61	87	148

PROJECT DESCRIPTION:

The scope of the engineering work to interface DSC with transmitters and receivers used by Coast Guard will be defined in preparation for an experimental system trial to be carried out this fiscal year.

The initial work will concentrate on DSC suitable for HF and MF bands.

To evaluate technical and operational aspects of DSC in detail, develop a systems approach most suitable for Coast Guard needs; and provide improved system specifications and cost estimates in support of a future national implementation.

Substantial input and participation by AMTD will be required.

REPORTS/DELIVERABLES:

(a) Equipment and software for a back-to-back test of a system suitable for MF and HF.

(b) Project and report, including cost estimates.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Industry will have the opportunity to provide hardware and software.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2446 - Remote Maintenance Monitoring System (RMMS)

STATUS: COMPLETED

KEY RESULT AREA: Safety & Public Correspondence

PROJECT OFFICER: Jean-Claude Cyr (DMT)

CONTRACTOR/PERFORMER: N/A

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	214	44	Ø	258

PROJECT DESCRIPTION:

- develop centre-to-multipoint RMMS system and conduct field trial;
- modify and enhance software package to meet centre-to-multipoint operations; and
- evaluate the pros and cons of using RMMS system as opposed to the conventional method of conducting routine maintenance.

REPORTS/DELIVERABLES:

- develop and centre-to-multipoint RMMS system;
- field trial RMMS equipment and prepare report and cost effective analysis; and
- report on choice of RMMS equipment, compatible with Coast Guard's need.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Industry has supplied off the shelf automated test instruments for the provision of remote maintenance and monitoring system based on Coast Guard's requirements. Software package developed for the Arctic will be modified and enhanced to satisfy the requirements for the stations at Harrington Harbour and La Romaine.

Industry will have the opportunity to avoid the necessary hardware and software for the Research and Develop system. Depending upon the results, the concept may be implemented on a larger scale with adherent opportunities for industry.

APPENDIX D-4

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

VESSEL TRAFFIC SERVICES

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

PROJECT LIST

KEY RESULT AREA: Vessel Traffic Services

Project #	Project Title	88/89 expenditures 000's
2097	Slow Scan Video Transmission	11
2099	Regional VTS Master Plan	39
2248	Technology Assessment and Life Cycle Management of VTS	55
	TOTAL	105

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2097 - Slow Scan Video Transmission

STATUS: ONGOING

KEY RESULT AREA: Vessel Traffic Services

PROJECT OFFICER: N. Stephens (AMA) (613) 990-3025

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	1	11	12	32

PROJECT DESCRIPTION:

To determine the operational and technical effectiveness and life cycle feasibility of slow scan video technologies on various waterway types.

The scope of work will encompass the trial and evaluation of at least 1 slow scan video system.

Past work was undertaken on an ad hoc basis and was not well documented. This study foresees a detailed evaluation and documentation of current technology.

Assessments will be accomplished through system lease for on-site trials, or, where more cost and time effective, testing of equipment using data gathered from existing operational systems. Alternatively, assessment could be undertaken at a Centre utilizing SSV.

Equipment evaluated will be restricted to that currently available on the market.

A minimum of 8 weeks would be required to develop a preliminary testing methodology and to make industry contact for systems to be evaluated.

(cont'd) ...

REPORTS/DELIVERABLES:

Separate Technical and Operational evaluation reports will be generated to document respective methodologies, results and recommendations.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Throughout this project COG operational and technical personnel will be in contact with industry representatives of the Canadian and International market.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2099 - Regional VTS Master Plan

STATUS: COMPLETED

KEY RESULT AREA: -

PROJECT OFFICER: Vessel Traffic Services R&D

CONTRACTOR/PERFORMER: Bureau of Management Consultants

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	41	39	-	80

PROJECT DESCRIPTION:

Update of the CCG LTCP component through integration of all appropriate demand/supply/operational and cost benefit analysis.

In order to update and provide additional information on the CCG LTCP we are now involved in the development of the detailed Capital Investment Plans (CIPs). Whereas the VTS National Study methodology is the basic planning framework, its completion in 1985 makes necessary the updating of information to reflect changes since original publication.

As part of the process, VTS operational and technical site surveys and associated activities will have to be undertaken in CG regions. Different sites have been identified in the Central Region (Sarnia Zone), and Maritimes Region (Fundy Zone) where additional information on traffic volumes and equipment performance is required. These site surveys (operational and technical), being an intrinsic element of the detailed VTS capital planning process, will be done at locations where deficiencies in traffic information is known to exist and as well where there is a sharp awareness of management problem spots.

(cont'd) ...

REPORTS/DELIVERABLES:

Information gathered through the VTS site surveys will be applied in a cost-benefit framework. Cost-benefit ratios for operational and technical options will be generated and assessed.

Where acceptable options are found, they will be incorporated into the Master Planning Document for implementation over a 10-year period.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The plan will expose the elements of the long term plan such that industry can effectively develop conceptual systems and equipment complements.

The potential will be presented for consultation on the part of industry towards addressing problematical sites. Industry will also be provided with indications of future needs towards their own development of R&D programs.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2248 - Technology Assessment and Life Cycle Management of VTS

STATUS: COMPLETED

KEY RESULT AREA: Vessel Traffic Services

PROJECT OFFICER: L. Barker (AMT) (613) 998-1545

CONTRACTOR/PERFORMER: CCG Personnel

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	-	55	Ø	55

PROJECT DESCRIPTION:

To evaluate the VTS technology and equipments available from the suppliers, thus generating a data base applicable to VTS procurements in the near future. To seek and encourage Canadian sources. To evaluate and develop modifications to existing systems either to reduce life-cycle costs or replace sub-systems no longer available from suppliers. Examples of such efforts are: radar modulator retrofit, low-cost radar Scan-Converters, standardized Radar Encoders for VTS, time-lapse VTS recording for which existing recorders may no longer be available, etc..

REPORTS/DELIVERABLES:

Evaluation reports on the technologies and equipments evaluated in cost benefit format.

Field evaluation reports on equipments and prototypes tested to validate the above.

The development of Canadian sources (relative to European sources) for VTS will improve the after sales-support and increase Canadian content, while fostering equipment that more closely meets the CCG requirements, at significantly lower life-cycle costs.

(cont'd) ...

Establishment of technical and cost estimate guidelines to be used in the preparation of planing documents and the subsequent equipment acquisition.

Replacement of recorders, which are no longer available, with (as a probable example) lower cost, and better operational performance time-lapse recorders for VTS. Ultimately, fully digital recording techniques will be investigated.

A recommendation for subsequent actions to apply to a mid-life retrofit to all of the West-Coast VTS radars.

A standard VTS radar encoder design to enable the replay of radar video tapes in a central location.

New technologies, standardization and economies of scale related to procurement will result in future O&M and Capital savings.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Throughout this project CCG operational and technical personnel will be in contact with Canadian and International market industry representatives for the supply of VTS equipment. Canadian suppliers have expressed a keen interest in involvement in this project. As a result of this work, Canada could benefit from the development of unique expertise in VTS technology. Industry will also be provided with indications of future needs towards their own development of R&D programs.

APPENDIX D-5

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

EMERGENCIES

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

PROJECT LIST

KEY RESULT AREA: Emergencies

Project #	Project Title	88/89 expenditures 000's
2224	Oil Spill Dispersing Water System	133
	TOTAL	133

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2224 - Oil Spill Dispering Water System

STATUS: COMPLETED

KEY RESULT AREA: Emergencies

PROJECT OFFICER: Ed Gauthier (AMG) (613) 990-3376

CONTRACTOR/PERFORMER: Canadian Petroleum Association

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	133	Ø	133

PROJECT DESCRIPTION:

1. High Pressure Nearshore System

This system would be designed to be used on smaller vessels such as Sea Trucks. The intention would be to replace the CCG WSL equipment with these systems.

The work would simply involve constructing a full-scale system based on the results and recommendations of the ESRF study, and then testing it in a field situation, first in a shakedown series of tests, then under actual conditions using oil and dispersant.

2. Water Canon System

This phase of the study would involve three steps:

i) testing of a "water canon" design in the laboratory (similar to the tank tests done in the ESRF study involving the high-pressure, low flow systems). The object would be to determine whether a high flow, low pressure water flow can supply sufficient mixing energy to disperse a treated oil slick, and if so, to determine the optimum operating conditions for the system;

(cont'd) ...

ii) testing of the MARY HICHENS water cannon for oil spill dispersion in an inshore situation. The testing would be based on the results and recommendations of the tank test work; and

iii) full testing of the MARY HICHENS water cannon in the offshore environment using oil and dispersants.

REPORTS/DELIVERABLES:

Tank Testing of Skimmers with waxy and Viscous Oils -
S.L. Ross Environmental Research Ltd.,
Ottawa, Canada - January 1989.

**INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY:** -

APPENDIX D-6

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

WATERWAYS DEVELOPMENT, MAINTENANCE AND PROTECTION

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

PROJECT LIST

KEY RESULT AREA: Waterways Development, Maintenance & Protection

Project #	Project Title	88/89 expenditures 000's
2095	Materials Research Low Maintenance Materials	49
2158	Material Handling Facilities at Various Cache Sites	10
2167	Speed Reduction for Safe Navigation in Restricted Channels	8
2169	Application of Ice Islands in Management of Winter Navigation	18
2180	Network re the acquisition of hydrographic data	74
2428	Littoral Investigation of Sediment	5
	TOTAL	164

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2095 - Materials Research Low Maintenance Materials

STATUS: ONGOING

KEY RESULT AREA: Waterways Development, Maintenance & Protection

PROJECT OFFICER: Reiner Silberhorn (AMA) (613) 998-1411

CONTRACTOR/PERFORMER: Gilman Corporation (USA), Donnite Fibres Québec

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	25	49	85	244

PROJECT DESCRIPTION:

This project is to find and test new durable materials suitable for use in buoys, building and other Marine Aids equipment.

REPORTS/DELIVERABLES:

Initial reports have been already received from Hay River. Further reports are due in December.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: NONE

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2158 - Material Handling Facilities at Various Cache Sites

STATUS: ONGOING

KEY RESULT AREA: Waterways Development, Maintenance & Protection

PROJECT OFFICER: FMM - Hay River

CONTRACTOR/PERFORMER: N/A

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	10	15	10

PROJECT DESCRIPTION:

To review and design a material handling system for various navigational aids caches. The system should allow for the safe movement of materials from the ship to shore and from shore to the ship. The materials are buoys, anchors, towers and other materials required in order for the District to maintain an efficient navigational system in the Hay River District. Due to the distances involved there will be requirements to survey the District over a two year period (approximately 50% of the sites each year).

To date, Regional Engineering has completed the 88/89 site visits and is drafting contract specifications. It is expected that the 88/89 project will go to tender by December 1988, with the final report due by March 1989.

In 1989/90 the remaining 50% of sites will be identified and surveyed.

REPORTS/DELIVERABLES:

Complete site plans for each site with a designed material handling system which will enable the Hay River District vessels to handle materials safely and quickly at the cache sites.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

Improved material handling methods (internal application).

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2167 - Speed Reduction for Safe Navigation in Restricted Channels

STATUS: ONGOING

KEY RESULT AREA: Waterways Development, Maintenance & Protection

PROJECT OFFICER: P. Nathan Daniel (AMA) (613) 998-1382

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	8	50	58

PROJECT DESCRIPTION:

Some early work, including preliminary in-house analyses on squat, its associated dynamic trim, and speed-power loss in ice infested waterways have been carried out at the Canadian Coast Guard's Hydraulic Research Centre (HRC). This data will be further analyzed and a comprehensive program for factors requiring further investigation, testing and analyses will be implemented. This will be complemented by technical literature search including similar research of other countries, preparation of in-house computerized data base and synthesis of the results and information. The result would be synthesis of the results and information. The result would be guidelines and parameters for regulating the passage of larger draft vessels at reduced speeds rather than re-design of existing channels.

REPORTS/DELIVERABLES:

- Report(s), guidelines, recommendations for in-house evaluation; and,
- Criteria, procedures to develop policy and for individual site applications.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

- Knowledge, guidelines for mission-related application in departmental responsibility of channel maintenance, safety; and,
- Contribution in improvement of opportunity for scientific applications to practical solutions, preparation of channel design guidelines.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2169 - Application of Ice Islands in Management of Winter Navigation

STATUS: ONGOING

KEY RESULT AREA: Waterways Development, Maintenance & Protection

PROJECT OFFICER: P. Nathan Daniel (AMA) (613) 998-1382

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	18	110	128

PROJECT DESCRIPTION:

All information/data on the existing ice islands, their characteristics, performance, etc., will be gathered, documented, analyzed. Other ice cover information, particularly in the St. Lawrence River, will be compiled. These will be assessed together with analytical/empirical methods that may be pertinent. Other surveys for complementary information will be identified and field work plans will be defined. Selected sites will be identified for implementation of proposed methods. Monitoring over several seasons is expected to be necessary.

REPORTS/DELIVERABLES:

- Technical data will be assembled in working formats to be available to HQ and Regional users.
- Technical reports on field surveys.
- Report(s) on final recommended methods/guidelines.

(cont'd) ...

**INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY:**

The gained knowledge and any possible guidelines will be of direct (or indirect) benefit to:

- CG operations, in keeping the waterways open;
- CG operations, in minimizing hazards due to ice-jams or sudden ice break-ups; and
- Shipping industry, in minimizing delays.

The results will assist in well founded justifications for related policy, decisions, and possible actions.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2180 - Network re the acquisition of hydrographic data

STATUS: COMPLETED

KEY RESULT AREA: Marine navigation system

PROJECT OFFICER: Jean-Claude Cyr (DMT) - Laurentian Region (418) 648-3825

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	0	74	0	74

PROJECT DESCRIPTION:

- acquire or have (2) portable electronic systems developed for the collection of hydrographic data;
- acquire a micro-computer dedicated to the compilation and management of hydrographic data;
- develop the software for system applications;
- establish a measurements network at specific locations along the river;
- test the system at 2 points in the network; and
- produce a project report with recommendations for the implementation of permanent sites.

Following the project approval, these steps could materialize over a one year period. Afterwards, an additional implementation project for a data acquisition network at several sites (CG presently uses water level readings coming from certain tide gauge wells between Montréal and St-François, Ile d'Orleans, belonging to Environment Canada) will be brought forward in cooperation with other concerned organizations in order to share the collected data.

(cont'd)

REPORTS/DELIVERABLES:

Two prototypes for portable hydrographic data collection systems.

A micro-computer, plus software for compilation and management of data.

The automation of the data reading process of hydrographic data will bring about a quicker access to information and will create an increase in safety with regards to ship movements.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The automation of the data collection and recording system will favour the implementation of high-tech equipment which will be more reliable and more precise than the present system.

The Laurentian region already has experience with electronic systems for measuring the tide; these are used for soundings. This expertise can be used for the study and choice of the hydrographic data collection and recording system.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2428 - Littoral Investigation of Sediment

STATUS: COMPLETED

KEY RESULT AREA: Waterways Development, Maintenance & Protection

PROJECT OFFICER: Kim Forgie (AMAC) (613) 998-1380

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	Ø	5	Ø	5

PROJECT DESCRIPTION:

(1) To measure the hitherto unknown, rapid and dramatic increases in bed strength of fine-grained littoral (intertidal) sediments; to correlate these increases with biological, atmospheric and oceanographic parameters; and to provide realistic parameters of erosion threshold, erosion rate, deposition threshold and deposition rate for numeric simulation.

(2) To develop techniques to measures and predict erosion and deposition thresholds and rates of fine-grained sediments in the submarine environment.

REPORTS/DELIVERABLES:

Through publication of the results and provision of data we shall enable consultants to complete hindcast modelling of the impact of changes made on the clam fishery in the Annapolis Basin.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: NONE

Through publication of the results and provision of data we shall enable other scientists and consultants to assess the impact of marine structures in other estuaries such as the Bay of Fundy, the Severn Estuary (U.K.) and Korea, where tidal power stations are being considered.

APPENDIX D-7

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

SEARCH & RESCUE OPERATIONS

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

PROJECT LIST

KEY RESULT AREA: Search and Rescue Operations

Project #	Project Title	88/89 expenditures 000's
2132	SAR Vessel/RCC Data Link Evaluation	3
2442	406 MHz EPIRB Investigations	19
2741	Optimal Visual and Electronic Sweep Width in Advanced Sea States	6
	TOTAL	28

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2132 - SAR Vessel/RCC Data Link Evaluation

STATUS: COMPLETED

KEY RESULT AREA: Search & Rescue Operations

PROJECT OFFICER: G.K. Running (FMT) (604) 984-3870

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	15	3	-	18

PROJECT DESCRIPTION:

The work will consist of a theoretical study of methods, procedures and frequency bands to be used for the transmission of data. An evaluation of the type of equipment to be used and a series of field tests will be conducted to verify the results of the study.

REPORTS/DELIVERABLES:

a) The output will be a report containing the results of the study and the field tests, with recommendations.

b) The intended application, if successful, will be towards developing a plan for implementation on SAR vessels.

c) The justification for the project, if successful, will be to provide more accurate and timely information to RCC on the area searched and to reduce the likelihood of areas within the search area being missed. This could reduce the time needed to effect a rescue and save additional lives, as well as reduce fuel consumption by SAR vessels and conserve resources.

INDUSTRIAL/SCIENTIFIC/
TECHNICAL OPPORTUNITY: NONE

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2442 - 406 MHz EPIRB Investigations

STATUS: COMPLETED

KEY RESULT AREA: SAR Operations

PROJECT OFFICER: Bill Zuck (AMT) (613) 998-1528

CONTRACTOR/PERFORMER: -

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	31	19	Ø	50

PROJECT DESCRIPTION:

The work consists of in house and contracted field evaluations, including land and shipboard sea trials where possible to determine signal strength and the relative probability of success at effective homing and retrieval of a 406 MHz EPIRB.

REPORTS/DELIVERABLES:

A report will contain results from EPIRB field tests offering recommendations and statistics on tests pertaining to reliabiity and usefulness of a 406 MHz receiver/decoder.

A 406 MHz direction finding (DF) device will be developed for possible implementation on SAR vessels and all test results will be reported including an impact study of the DF device on the enhancement of SAR operations.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

This project will provide information to industry assisting them in their development of 406 MHz EPIRBs in the future.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2741 - Optimal Visual and Electronic Sweep Width in Advanced Sea States

STATUS: COMPLETED

KEY RESULT AREA: SAR Operations

PROJECT OFFICER: A. Armstrong (SARCURE)

CONTRACTOR/PERFORMER: NORDCO LTD.

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
RD&ES	201	6	Ø	207

PROJECT DESCRIPTION:

The main objectives of this project are:

a) collect data to enhance visual and electronic lateral range parameter regression in advanced sea states conditions;

b) provide information on the optimum detection technology for use by CCG SAR units; and

c) Define and revise search procedure.

REPORTS/DELIVERABLES:

A final report will be available for analysis. This will include all acquired data, results of regression analysis, conclusions and observations from the experiment and recommendations and costed proposals for future action.

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The project will provide increased knowledge of search parameters and the most effective combination of visual and electronic detection and procedures to use.

Business and Financial Risks are negligible.

Technical risk is moderate due to the potential severity of the environment in which the experiment will be conducted and the associated effects upon equipment, personnel and resources.

APPENDIX D-8

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

DIRECTION AND ADMINISTRATION

RESEARCH AND DEVELOPMENT AND ENGINEERING STUDIES PLAN (RD&ES)

PROJECT LIST

KEY RESULT AREA: Direction and Administration

Project #	Project Title	88/89 expenditures 000's
-	-	-

APPENDIX E

PROGRAM FOR ENERGY RESEARCH AND DEVELOPMENT

(PERD)

APPENDIX E

1988/89 PERD BY KEY RESULT AREA (KRA)

AND SOURCE OF FUNDS

KEY RESULT AREA	PERD 000's	OTHER* 000's	TOTAL
Arctic R&D: Safety & Regulatory	947	119	1,066

* Other is $49K from CCG and $70K from NRC for Ice Crushing project.

1988/89 PROGRAM SUMMARY BY PROJECT AND KEY RESULT AREA

PROJECT LIST

KEY RESULT AREA: PERD

Project #	Project Title	88/89 expenditures 000's
(AWRSP) 2063	Interaction with Actual Ice Conditions	60
(AWRSP) 2082	Ice Failure Criteria - Ice Crushing by Indentation	189
-	Beaufort Sea Accessibility Study	410
-	Eastern Parry Channel Ice Regime Study	407
	TOTAL	1,066

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: 2063 - Interaction with Actual Ice Conditions

STATUS: ONGOING

KEY RESULT AREA: Arctic Research & Development

PROJECT OFFICER: J. O'Connor (AMEB) (613) 990-3093

CONTRACTOR/PERFORMER: National Research Council

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
AWRSP	-	-	295	295
PERD	-	60	448.8	508.8

PROJECT DESCRIPTION:

The objective of this project is to study ship/ice interaction in real Arctic conditions to advance the prediction of ice loads on all parts of a ship. The current methods for predicting ship/ice loads will be reviewed, and ice features and properties analysed. A theoretical model is being developed for ship/ice interaction and experiments will be conducted to verify and revise the methods developed.

REPORTS/DELIVERABLES: None to date

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: -

PROJECT STATUS REPORT 1988/89

PROJECT NUMBER/TITLE: 2082 - Ice Failure Criteria - Ice Crushing by Indentation

STATUS: ONGOING

KEY RESULT AREA: Arctic Research & Development

PROJECT OFFICER: J. O'Connor (AMEB) (613) 990-3093

CONTRACTOR/PERFORMER: National Research Council, Institute for Research in Construction

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
CCG	92	49	60	201
PERD	64	70K	60	194
NRC	-	70K	-	70

PROJECT DESCRIPTION:

This project investigated the mechanisms of ice failure and ice crushing, to better understand structure/ice and ship/ice interaction and predict ice pressures during impact and indentation.

The first part of the project included a literature review and analysis, and the development of an ice failure prediction model. Indentation (using an "indentor" to simulate ice failure) and impact tests were completed. The interaction of the processes involved in ice microcrack formation and in ejection of pulverized ice was found to be the key to the calculation of pressures in brittle compressive failure. The peak pressure is governed by the damage mechanism in the ice mass, but the time varying pressure is due to the interaction of the damage and ejection processes.

REPORTS/DELIVERABLES:
- Ice Crushing by Impact and Indentation, a Literature Review, February 1988
- Final Report - October 1989

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY:

The project will result in a major advance in ship/ice interaction dynamics and a major advance in dynamic modelling of ships generally. The technology can be applied to the study of wave loads.

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: - Beaufort Sea Accessibility Study

STATUS: ONGOING

KEY RESULT AREA: Arctic Research & Development

PROJECT OFFICER: J. O'Connor (AMEB) (613) 990-3093

CONTRACTOR/PERFORMER: Canarctic Shipping Limited

FINANCIAL SCHEDULE:	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
PERD - Phase I	-	280K	70	350K
- Phase II	-	130K	70	200K

PROJECT DESCRIPTION:

Phase I of this project investigating the environmental limitations to deep-draft shipping operations along the Southern Route of the North-West Passage is now complete. Three years of winter synthetic aperture radar (SAR) data over the consolidated waterways of the Southern Route (1986-89) was collected and analyzed. The conclusions highlight the potential feasibility of year-round trafficability of deep-draft tankers along the Southern Route. More detailed work in this area (Phase II) will commence in 1989-90.

REPORTS/DELIVERABLES: TP 9906 E

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: -

PROJECT STATUS REPORT
1988/89

PROJECT NUMBER/TITLE: - Eastern Parry Channel Ice Regime Study

STATUS: ONGOING

KEY RESULT AREA: Arctic Research & Development

PROJECT OFFICER: J. O'Connor (AMEB) (613) 990-3093

CONTRACTOR/PERFORMER: Canarctic Shipping Limited

FINANCIAL SCHEDULE:

	PREVIOUS YEARS	88/89	FUTURE YEARS	TEC
PERD	-	407K	-	407K
CCG	-	-	269.5	269.5

PROJECT DESCRIPTION:

This is a continuing project collecting research to allow for the planning of year-round navigation in the Eastern Parry Channel. PHASE I consisted of collection and analysis of a set of synthetic aperture radar (SAR) mapping data of the channel area obtained from a series of aircraft overflights.

PHASE II will continue the data collection and compare the ice conditions of 1989 with those of 1988, identifying the time period when old ice/ first-year ice interaction impedes navigation.

REPORTS/DELIVERABLES: Milestone Report #5

INDUSTRIAL/SCIENTIFIC/ TECHNICAL OPPORTUNITY: -

APPENDIX F

UNSOLICITED PROPOSALS (UP'S)

UNSOLICITED PROPOSALS SPONSORED/FUNDED BY CCG IN 1988/89

I) Proposals Sponsored in 1988/89

UP #	PROPOSAL TITLE/PROPONENT	TEC	Prev. Years	1988/89			1989/90			1990/91			REMARKS/SPONSORING CG REGION
				DSS	CCG	Other Dept.	DSS	CCG	Other Dept.	DSS	CCG	Other Dept.	
A8/001	Littoral Investigation of Sediment Properties (Acadia Centre for Estuarine Studies)	191.5		26	5	15	115	-	30	-	-	-	AMA sponsored from RD&ES, project #2428.
A8/010	System for Automatic Extraction of Ice Velocity and Characterization and Characterization Data from Sequential Satellite Imagery" (Artic Sicences Limited)	332		149	-	-	117	20	46	-			AMF sponsored from FCIP, project #2916.
B7/023	Rational Design Procedure for breakwaters Using Concrete Armour units (W.F. Baird & Association)	72		42	30	-	-	-	-	-	-	-	AMH sponsored from under O&M funds, 8103-3-3.
D8/016	Small Liferaft Designed for the Canadian Inshore Fishery (Dunlop-Beaufort Canada Limited)	257		-	-	-	-	15	242 (TDC)	-			AMS sponsored from RD&ES, project #2203.
F8/002	In-Situ Weld Repair of Internals to Shell Plating In Ice Transiting Ships (Fleet Technology Limited)	146	-	-	18	-	-	103	-	-	25	-	AMF sponsored from FCIP, project #2970.
F8/007	Evaluate a New Ice Modelling Materials "Bead-Ice" based on Existing Field Studies & Model Scale Results" (Fleet Technology Ltd.)	191.8	-	-	-	-	-	-	-	-	-	-	Rejected as UP - August 31, 1989.
F8/008	Model Testing the Behaviour of the Ice Cover in the Vicinity of Bridge Piers with Berm Protection (Fleet Technology Limited)	138.4		45.7	94.3	-	-	-	-	-	-	-	AMA sponsored, project #2094. (Branch minor capital)

UNSOLICITED PROPOSALS SPONSORED/FUNDED BY CCG IN 1988/89

I) Proposals Sponsored in 1988/89

UP #	PROPOSAL TITLE/PROPONENT	TEC	Prev. Years	1988/89			1989/90			1990/91			REMARKS/SPONSORING CG REGION
				DSS	CCG	Other Dept.	DSS	CCG	Other Dept.	DSS	CCG	Other Dept.	
G8/007	Development of a Standardization for Advanced Ship control Systems (Gastops Limited)	218	-	-	-	25	-	20	55 (86 TDC)	-	32	-	AMF sponsored from FCIP, project #2900. Rejected as UP March 8/89.
G8/012	Investigate Systematically, Factors Affecting the Astern Performance of Icebreaking Ships (German & Milne Inc.)	152	-								77	75 (TDC)	AMF sponsored from FCIP, project #.
L8/010	Helicopter Sensing/Tactical Mission Avionics System (Lelton Systems Canada Limited)	476.2	-	-	-	-	-	-	-	-	-	-	Project CANCELLED 90/02/28.
M8/021	Statistical Significance of Local Brittle Zones In Heat Zones in Welded Structures (Fleet Technology Limited)	291.3	-	5	-	51	115	-	20	-	-	-	Private sector funding 100K.
S8/018	Development of Remote Data Buoy Real Time Current and Weather Measurement at Sea (Seakem Oceanography Limited)	696	-	-		-	196	225	-	-	225	-	AMR sponsored from RD&ES, project #2569.
S8/032	Development of a variable Geometry Buoy for use in Search & Rescue at Sea (Seimac Oceanography Limited)		-										Combined with S8/018 above.

UNSOLICITED PROPOSALS SPONSORED/FUNDED BY CCG IN 1987/88

II) Proposals Sponsored in 1987/88

UP #	PROPOSAL TITLE/PROPONENT	TEC	Prev. Years	1988/89			1989/90			1990/91			REMARKS/SPONSORING CG REGION
				DSS	CCG	Other Dept.	DSS	CCG	Other Dept.	DSS	CCG	Other Dept.	
A-025	Structural Steels for Arctic Class Ships (Arctec Canada Limited)	883	-	86	31	100	86	30	350	-	100	100	AMN sponsored from AWRSP Plan, project #2045.
B-006	Sea Ice SAR Signature Analysis and Interpretation Manual (F.G. Bercha & Associates (Alberta) Limited)	100	-	-	-	-	-	-	-	-	100	-	AMN sponsored from AWRSP plan, project #2084-4.
M-025	The Sea Ice Climate of the Northumberland Straight Crossing Project (MacLaren Plansearch Ltd.)	620	264	156	10	190	-	-	-	-	-	-	CM-Dartmouth sponsored from AWRSP. (DPW $150K, DFO $40K, ACOA $135K).*
P-015	Marine Access to Northern Sites During Polar 8 Operations in Arctic Waters Phase I: Description of Sites & Regions, & Database Development (Polar Sea Research Limited & Norland Science and Engineering Limited)	200	-	-	158	-	-	42	-	-	-	-	AMN sponsored from AWRSP plan, project #2067.
T-007	Development of a Comprehensive Numerical River Ice Model (Tecsult Inc.)	425	-	225	-	-	74.9	90	35.1	-	-	-	AMA sponsored from RD&ES plan (DOE $55K, DIAND $30K) project #2160.

* ACOA Atlantic Canada Opportunities Agency

UNSOLICITED PROPOSALS SPONSORED/FUNDED BY CCG IN 1987/88

III) Proposals Sponsored in Previous Years for which 1988/89 CCG Funds were Allocated

UP #	PROPOSAL TITLE/PROPONENT	TEC	Prev. Years	1988/89			1989/90			1990/91			REMARKS/SPONSORING CG REGION
				DSS	CCG	Other Dept.	DSS	CCG	Other Dept.	DSS	CCG	Other Dept.	
A-023	Study of the Effect of Weld Metal Composition on its Sea Water Corrosion Resistance and Toughness (Arctec Canada Limited)	88	47	-	28	10	-	-	-	-	-	-	AMF sponsored from FCIP, (EMR $20K) project #2927.
A-037	Effect of Welding Process and Parameters on Weldability of Selected Primers (Arctec Canada Limited)	140	26	-	102	-	-	12	-	-	-	-	AMF sponsored from FCIP under project #2952.
A-050	Ice Flow & Blockage Investigation of Shrouded Propellers (Arctic Research & Development Limited)	217	147	-	20	50 (TDC)	-	-	-	-	-	-	AMF sponsored from FCIP plan, project #2939 (TDC $80K)
B-024	Arctic Structures Corrosion (F.G. Bercha and Associates (Alberta) Limited)	135	57.8	42.2	35	-	-	-	-	-	-	-	AMN sponsored from AWRSP plan, project #2066.
W-014 DP	The Development and Incorporation of New Technology into our Marine Controllable Pitch Propeller (Wagner Engineering Limited)	345		140	1	-	118	30	36	-	20	-	AMF sponsored from FCIP, project #2501.
W-6	Arctic Utility, Support Vehicle (Watercraft Offshore Canada Ltd.)	1.8M	448	-	1.3	-	-	109	-	-	-	-	AMF sponsored from FCIP, project #2928.

APPENDIX G

RESEARCH AND DEVELOPMENT REFERENCE PUBLICATIONS AVAILABLE

R&D REFERENCE PUBLICATIONS AVAILABLE

TP 6819	Managerial Handbook for the Financial Control and Status Reporting of Research and Development Projects
TP 6570	CCG R&D Contracting Guidelines for Project Managers
TP 6569	CCG Research & Development Publication Standards for Contractors
TP 7370	Unsolicited Proposals (UP's) Guidelines and Procedures

APPENDIX H

SUMMARY OF PROJECT REPORTS

Arctic Waters Regulatory Studies Program

Arctic Research & Development Safety & Regulatory

Project	TP No.	Title
No. 2062	TP 8238	Physical modelling of ship/ice interaction. Technical Research Centre of Finland/Arctec Canada Limited - Dec. 1986
No. 2086	TP 7652	Update of the Arctic SAR database. Fleet Technology Ltd. - August 1988
No. 2087	TP 6329	Damaged stability criteria for vessels operating in the Arctic Shipping control zones. Arctec Canada Ltd.
No. 2091		Canadian Arctic Marine Ice Atlas, Winter 1987/88. Norland Science and Engineering Ltd. - September 1988
No. 2104	TP 9158	Arctic survival equipment tests 1987/88. Melville Shipping Ltd. - March 1988
No. 2139		Arctic Winter Marine Ice Atlas, Winter 1987/88 Phase II, Task I. Canarctic Shipping Co. Ltd. - March 1988
No. 2151	TP 7397	Bent Horn Demonstration project MV Arctic Ice Navigation Support Exercise report 1985. Canarctic Shipping Co. Ltd.

Northern Operations Research & Development

Project	TP No.	Title
No. 2140		Environment Atlas for Lancaster Sound Oil Spill - available Department of Environment (DOE)

Fleet Capital Investment Plan (Ships)

Project	TP No.	Title
No. 2975	TP 9709	Field Assessment of Weld Corrison on the M.V. "Arctic". Centre for Frontier Engineering Research - March 1989

(cont'd) ...

Research and Development and Engineering Studies Plan

Short Range Aid To Navigation

Project	TP No.	Title
No. 2163		Prescott Base Buoy Maintenance Facility Evaluation. Corrspec Consultants Inc.
No. 2180		Executive Summary Report for R&D Project Network re: the Acquisition of hydrographic Data. Michel Bernard. February 1990

Ship Safety

Project	TP No.	Title
No. 2128	TP 9578	Impact of IMO Drug Cargo Vessel Sub-division when applied to Canadian Ships. Fleet Technologies Ltd. - December 1988

Emergencies

Project	TP No.	Title
No. 2224		Tank Testing of Skimmers with waxy & Viscous Oils. S.L. Ross Environmental Research Ltd. Ottawa, Canada. - January 1989

Search and Rescue Operations

Project	TP No.	Title
No. 2132		Evaluation of Ship Location and Reporting Systems. Techwest, Division of Fleet Aerospace - March 1988
No. 2741		Target Detection Experiment-Canso Bank, 1988 - October 1989